THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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READY!

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

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CORRUPTION.

THE Prevention of Corruption Act has now been in force just over a month; and so far as we have observed, no prosecution has yet been entered under its provisions. But it has excited a certain amount of attention—none too much, in view of its importance to the trading community.

The last Christmas under the old law has passed and gone, with all its bribes and tips and presents from seller to buyer, cash, turkeys, cigars, cases of wine and miscellaneous articles, only to be enumerated by reference to a "stores" catalogue. Will next Christmas be the same as its predecessors, or will the new Act really see the end of these degrading customs?

And if these outward and open manifestations of the brotherly love of the man who has something to sell for the agent of the man who has something to buy really cease, will the evil simply assume new and more sinister shapes? Is it actionable to play a game of chance with the agent of a buyer and lose the game? Is it actionable to make a loan to the friend of a friend, who happens to be the agent of a buyer? Is it actionable to buy a patent from an ingenious engineer who has orders to give out?

What is corrupt consideration? Business men may well give a little thought to the point, because a mistake as to the precise meaning of those two words may decide whether some of them are inside or outside the walls of a gaol next Christmas. We hope they will not feel insulted by this plain statement of fact. What we fear is that the "old hands" at the game will continue to play it in the old way, in perfect secrecy, unscathed; and that the unwary, careless, easy-going and much less criminal man may be found out in a technical offence and severely punished.

We have seen several hysterical letters, stating that it will be dangerous to tip a porter or to give "cabby" an extra twopence. Anyone who raises such a question has, of course, no notion of the meaning of the word "corruptly."

Unfortunately, the new law offers no new facility for finding out; but it makes it an offence to offer or to solicit a bribe. The buyer (for another party) who asks for a consideration will place himself in a very dangerous position. The buyer who even interviews a doubtful seller alone will place himself in a risky position; and we strongly advise all engineers who value their reputation to take care how they treat with the representatives of firms not known to be honest.

The fact is that, when all is said and done, the law will only be effective in so far as it is supported by public opinion. We are glad to see signs that public opinion is waking up. Chambers of Commerce and many public bodies have passed resolutions favourable to the Act. The Local Government Board has issued a circular. The trades have held meetings. It is said that Lancashire coal merchants have met

to consider how they are to manage without giving the customary bonus to the engine man of the mill on every ton of coal delivered.

A very useful digest of the Act and its bearings on business transactions by Mr. C. J. Howarth, solicitor, has reached us. Mr. Howarth shows the wide range of the Act, which clearly covers even corrupt transactions never carried through, but only contemplated. On the other hand, he shows that those innocent of corrupt actions need have no fear.

Perhaps the most encouraging sign of all is the formation of a league, called the Secret Commissions and Bribery Prevention League. This league has for its objects the formation of public opinion and the publication of cases; to inquire into alleged corrupt practices and to institute proceedings; and it is well supported by prominent business men at the outset. The secretary is Mr. A. S. W. Gwyn, and the temporary office, 58, Coleman Street, E.C. We hesitate to criticise such a useful enterprise; but we are strongly of opinion that such a society should aim at receiving upon its roll of membership every honest trader in the country. To this end the rate of subscription should be reduced to a very much lower figure; at present it ranges from £3 3s. for a company to £1 11s. 6d. for an individual.

One thing which should not be overlooked, is the question of the education of the young in regard to honourable dealing. We should like to see the Minister of Education issue a special circular to every elementary school, setting forth the evils at which the new Act is aimed. Many a young man makes his first false step from a lack of exact knowledge. He may be sent out to get orders by a prosperous employer who, perhaps, adds to the solid eminence of a successful business man, a spurious reputation for piety; and he may be told that it is the custom to share his commission with certain buyers, and he is expected to do it, and say nothing about it. An exact instruction as to the law, and the terrors it holds for himself, would be of the utmost value to that young man; and it would probably assist him also to know that in the event of discovery his employer would certainly deny all responsibility, and hold up his hands in horror at such practices.

Our Universities, Technical Schools and Institutions should also take steps to see that all students and members are well informed as to the new law. So insidious is the disease that even a sense of honour is not always sufficient, in the absence of knowledge as to the many forms which corruption assumes.

As a circular on this subject, the advice of Polonius to his son would be hard to beat:—

Look thou character!

. . . . . .

Do not dull thy palm with entertainment of each new-hatched, unfledged comrade.

. . . . . .

Neither a borrower nor a lender be.

. . . . . .

This above all, to thine own self be true,
And it must follow, as the night the day,
Thou canst not then be false to any man.

Cables and the Colonies.

In a recent issue we discussed an important address delivered by Sir Sandford Fleming before the Eighty Club on a proposal to establish a great Imperial Intelligence Union to promote the consolidation of the Empire, and we now have before us another paper, which was read by Mr. Arthur W. à Beckett at a meeting of the Royal Colonial Institute in December last, dealing more or less with the same subject, thus showing that it is receiving earnest consideration. The paper was entitled "The Colonial Press," and gave rise to an interesting discussion by representatives of the Australian, Canadian, West Indian and other Colonies' Press. Mr. à Beckett stated his belief that the best traditions of the British Press were sometimes safer in the hands of the Colonies, and he had found during a recent visit that his colleagues in Jamaica were as keenly alive to the interests of the Empire as in London. An interesting comparison was made of the state of things before the advent of telegraphic facilities to New Zealand, when news of important Empire events reached far distances by post or other similar means, and the paper elicited that the Press recognised the necessity for still greater facilities than are at present available. Mr. à Beckett understands the chief drawback to the existing state of affairs, from a New Zealand point of view, to be that the cable service is designed primarily for Australian readers, and does not give news affecting New Zealand as much prominence as would be given were the service purely a New Zealand one. A complaint also comes from Canada that the dailies get British news through New York, but the Canadian Associated Press, subsidised by the Canadian Government, and represented by a Canadian in London, should change this state of affairs. However, these instances show that the system is disjointed, and point to the utility of establishing a central organisation. Mr. à Beckett admits that when Britons are at the head of affairs in the centres of information, British interests are not allowed to suffer, and he proposes the creation of a society founded in the best interests of inter-colonial journalism, its title to be the "Guild of the British Imperial Press." The initiation of a small body to consider this urgent question in time to advise and confer with the Colonial Representatives coming over this year would seem to be the next necessary step to be taken.

We believe the further consideration of Empire development and consolidation will help to place the question of the dissemination of news suited to the needs of the Empire on a more settled foundation. Its aspect is probably more political than scientific, but as one of the most important factors is the closing up of gaps in the Imperial chain of cables, there seems to be no apology needed for its extended consideration in our columns. The cost of the undertaking and the ways and means of its development and maintenance should not be left to chance, for the scheme is easy to conceive and it is not difficult to carry out a service at once profitable to the Empire, and at the same time fully under the supervision and guidance of any governmental body, so far as the dissemination of news is concerned. An organisation may be set up as sober and as judicial as the judiciary of this country, which cannot be affected by any Imperialist statesman in any way whatever. It is upon these lines then that we think this vital question should be pursued, and with all the energy possible if it is to be rescued from its snowbound condition. The first step in this direction was taken at the meeting of the Associated Chambers of Commerce last year, when a resolution in favour of the Imperial Press supply was adopted, and it is to be hoped that further concentrated effort will soon lead to the successful issue of this question.

Improvements in Telegraph Working.

Under the heading of "Agitation and Invention," our contemporary the *Telegraph Chronicle* refers to an improved form of polarised sounder which has just been introduced by the Post Office.

A polarised sounder is used in the metropolitan intercommunication system, which provides for metropolitan

offices being inter-connected by means of a switch located in the Central Telegraph Office, so that telegrams may be sent direct instead of being received and re-transmitted by the central office. Under this scheme central battery work is in use ; and as the polarised sounder requires no relay, the apparatus at the out offices is reduced to a minimum.

The polarised sounder hitherto used is a vertical form, somewhat similar to the old Neale's dial instrument. The new form is simply the ordinary pony sounder, but with the soft iron yoke removed, and a small horse-shoe permanent magnet placed under the cores, which are so polarised as to oppose the spacing current and assist the marking current. In the old form the armature was polarised. In both types the coils are wound to a resistance of 5,400 ohms, shunted so as to give a joint resistance of 4,500 ohms.

By winding the new polarised sounder differentially, it can be used for duplex working, thus dispensing with the necessity for relays.

Central battery telegraph working is being rapidly extended throughout the country, and, as in London, so in the provinces, the relayed sounder is being rapidly displaced by the polarised form. In the system of C.B. working adopted, the sounder is actuated by impulses from a condenser, which is charged and discharged by the movements of the transmitting key at the sending end.

The advantage of this system of C.B. working over the closed-circuit system in use in America, is that no current flows except when the condenser is operated. In this country, too, the use of the condenser admits of joining intermediate offices in "leak" instead of using a loop.

A Libel on British Firms.

Last week the Hull Electric Lighting Committee, adjudicating tenders for a steam dynamo of 500 kw., was recommended by the electrical engineer to accept a German tender (not the lowest) on the ground that German firms could make better high-pressure machinery than British manufacturers. The argument was ostensibly based on previous experience with British plant. The Hull electricity supply is carried on with high-pressure direct-current transmission to sub-stations, and apparently breakdowns had been not uncommon.

It appears, however, that only one British firm was asked to tender, and we surmise that this was only a matter of form, for clearly it was never intended to place the order for the dynamo at home. The engine, on the other hand, is to be British.

We feel bound to protest strongly against the sweeping and unjustifiable condemnation of British work attributed to the Hull electrical engineer. To begin with, what evidence is there to show that the existing machines were at fault, rather than the management of them ? There are many perfectly successful examples of English dynamos and motors working at pressures up to 2,000 volts ; and in Manchester 3,000-volt machines have been used, no difficulty being experienced in their construction or operation. The voltage at Hull is 2,000.

We can name three British firms, without hesitation, which are experienced in such work and well able to carry it out ; and a fourth, one of our largest concerns, which actually owns the Thury patents in this country, and is in possession of the unique experience of M. Thury, who has built a d.c. machine of 25,000 volts, and thinks nothing of a mere 2,000 volts ! Only last August we described his system of d.c. transmission from Moutiers to Lyons, at pressures up to 50,000 volts.

In the face of these facts, we can only characterise the statement in question as preposterous. There was, apparently, no intention to place the order with a British firm, and no desire to do so. Hence the abuse of British work.

ON THE PREVENTION OF BREAKDOWNS IN CENTRAL STATIONS.

By "RESEARCH."

It is the rule in central stations to make a record of all breakdowns on the daily log-sheet, but unless something further is done, the number of breakdowns will not tend to diminish. Failure of supply or defective supply tends to shake the faith of the general public in electricity, and retards its general adoption. A book should be kept where all breakdowns, however slight, are recorded. A careful study of this book will show how many accidents may be avoided. The writer has kept such a book for several years, and always made a point of getting full information from persons present during the breakdown, if he did not happen to be there himself. The stations he was connected with were fitted with the most up-to-date appliances by the best makers.

Accidents that caused either temporary failure of supply, or defective supply, were classified under four headings :—

I.—Defective machinery or apparatus.
II.—Preventable accidents.
III.—Faulty automatic apparatus.
IV.—Accidents due to carelessness.

The following table shows which class was responsible for the most breakdowns :—

Classification.	Number of breakdowns.	Percentage of total.
I.—(*a*) Engines or accessories ...	3	6
(*b*) Generators or motors ...	9	18
(*c*) Cables or wiring	10	20
II.—(*a*) Engines or accessories ...	2	4
(*b*) Generators or motors ...	4	8
(*c*) Cables or wiring	6	12
III.—(*a*) Mechanical	2	4
(*b*) Electrical	7	14
IV.—General	7	14

First of all, a brief description of the various breakdowns will be given, and then the lessons the writer has drawn from them by studying the causes.

Dealing with the first class and sub-dividing this, as shown in the table, we find that the three engine breakdowns were unavoidable, and the engine room staff could not be blamed in any way. Generators and motors used in works were responsible for nine breakdowns. Two of these were due to commutators and four to high tension coils on alternators giving way. Out of the ten defects on cables, six were due to the insulation of high-tension cables breaking down.

Class II.—Many of these might almost have been classed under the heading "carelessness," but that class has been reserved for inexcusable carelessness.

(*a*) Engines or accessories.—Two stoppages were due to bolts working loose and necessitating the engines being stopped to tighten them up.

(*b*) Generators and motors used in works.—Two cases of shunt connections to adjustable resistances being caught in the gearing to regulating handles, and the shunt circuits being broken. One case of a shunt connection on a machine being almost broken by a man in cleaning the machine, and the shunt circuit failing whilst the generator was on load. There were two cases of cables earthing to tubing through the latter not being fitted with insulating bushes. In the first case this caused a condenser motor to stop at an unfortunate time, and in the second case the cable led to the only balancer in use at the time, and thus caused serious trouble. Another case was the fuse blowing on the air-pump motor. This was rather a common accident at one of the stations dealt with, and though as a rule it was of little consequence, yet sometimes it seriously affected the supply.

(*c*) Switchboards and cables.—A generator cable fell out of the thimble connecting it to the switchboard and cut the machine off load, thereby throwing a heavy overload on the battery. This was, of course, caused by overheating, either of the switch contacts or through the defective soldering of the cable into its thimble. In many central stations the generator and feeder cables are taken vertically downward from the switchboard with very little support, other than that afforded by the thimbles. Another case was a fire on a high-tension switchboard originated by the breakdown of the insulation of a synchronising cable. The board was fitted

with oil-break high-tension switches, and the boxes containing the oil used to leak occasionally, and the fact of the surface of the slate being covered with a film of oil enabled the arcing mentioned to start a fire, necessitating the board being made dead to get the fire under.

A serious case of fire was caused by sparking which set fire to the insulation of cables leading to the switchboard and out of sight. Hundreds of pounds' worth of damage was done, the lighting and power supply interrupted for several hours, and the traction supply stopped for a day or so. The last case of this class was caused by a part of the wiring for lighting the station, earthing to the steel tubing. This tubing being of the slip-joint variety, was a poor earth, and some distance from the original fault, the steel tubing arced to the lead covering of a large feeder, burning it through and starting a fault on the feeder. Through the fault on the wiring, the station was thrown into darkness.

Class III.—There were nine breakdowns caused by the faulty acting of automatic appliances. This class is subdivided into two divisions.

(*a*) Mechanical appliances.—In one case the automatic knock-off gear fitted on an engine, to shut the steam off if by any chance the speed exceeded a certain limit, failed to act. This caused an excessive rise in voltage, a bad thing for consumers using their lamps at the time. The second case was more serious. An overload valve fitted to an engine to admit high-pressure steam direct into the low-pressure cylinder in the event of a sudden heavy overload, apparently worked all right, but after paralleling another generator, this valve could not be got to return to its original position, and the engine was taking steam at an excessive rate. The boiler pressure was considerably reduced before another engine, started up cold, could be got on load to take the place of the faulty engine.

(*b*) Electrical appliances.—Numerous cases of circuit breakers, both of reverse current and overload types, acting when they should not have acted, or failing to act when they ought to have done so. In two cases generator armatures were seriously damaged by their circuit-breakers remaining in during a fault.

Class IV.—Accidents caused by carelessness of staff.—A 1,000-H.P. set on load was pulled up and had to be taken off the bus-bars at once, owing to the bearings not having been inspected several times during the shift. The engine was fitted with forced lubrication, and one of the supply pipes had become obstructed, causing the overheating of the unlubricated part.

Three cases were due to the carelessness or ignorance of switchboard attendants. The first was due to the reckless synchronising of two alternators. In the second case a wrong switch was put in by mistake, switching a standing machine on to the bus-bars instead of a machine that had just been run up. The third mistake was a little excusable. An alternator was being run up on some high tension feeders that were not alive at the time. The exciter refused to generate, and leaving all switches in the attendant went to the exciter to investigate. It suddenly started generating, and caused an excessive pressure to be applied to the cables, which broke down.

One accident was due to an official interfering with the switchboard, instead of leaving matters to the attendant-in-charge. The last case nearly resulted in the death of two men. The outside repair gang of a traction system were not notified of the current being left on the trolley wires one night for special reasons. As a general rule the current was switched off from 12 midnight to 4 a.m. The men were working at a feeder pillar, and could not get the front door open. The back door would open, and they therefore got a crowbar and tried to force open the front door, incidentally shorting the bus-bars and receiving severe shocks.

We come now to the description of different methods for keeping the number of interferences with the supply of electricity down to the minimum.

Continuous-current generators and motors used in the works.—A weekly insulation resistance test should be taken, using an ohmmeter and generator, the latter giving twice the working pressure of the machine tested. The main thing to find out is whether the machines have an insulation resistance above or below a certain fixed safe limit. All shunt connections on machines should be made with much larger wire than is necessary for current carrying purposes. The cleaners should be warned to keep clear of the wires, and fancy coils and loops should be avoided, especially near any of the gearing connecting the regulating handle on the switchboard with the adjustable resistance.

High-tension alternating-current generators are best left untested, except for an extra-high-tension test immediately after the erection of the machines at the works. Coils will break down quite soon enough without meeting trouble halfway by high-tension tests. A spare generator should always be in readiness for use in case of a breakdown, as with a high-pressure supply, a generator or cable is either good or bad, and the transition from one state to the other is instantaneous.

Batteries are invaluable in central stations. If the the generators on load fail, the obliging battery supplies all or part of the system until repairs are effected, although it is overloaded two or three hundred per cent. In a three-wire system, if the balancers breakdown the battery does the balancing, and if a heavy out-of-balance comes on, it can be dealt with by charging one-half of the battery and discharging the other half. Batteries often get very badly treated, and this is the reason they are in disrepute in many stations. In high tension supply stations a motor-generator and a battery form a very good combination. Economy can be effected by shutting down the engines at times of very light load, and keeping up the supply by running the motor-generator from the battery.

Cables and wiring in works.—The cables connecting the generators to the switchboard should be of the fireproof class, carried either in troughs or on shelves fixed to the sides of the foundations until they have to rise to the switchboard. They should be fastened to the wall by insulated cleats or lashed to insulators. Where they pass through the floor of the switchroom or switchboard gallery, they should be pushed through earthenware ducts fixed in a vertical position against the wall. The holes should be completely closed by split wooden bushings fitting round the cable; this will greatly decrease the chances of fire damaging the switchboard. In many stations there is a large hole behind the switchboard through which the cables are brought up: in the event of a fire below the switchboard where so many cables, shunt resistances, &c., are placed, this hole acts as a chimney for the flames, and may result in untold damage being done. The writer can call to mind a serious fire that would have done comparatively little harm if earthenware ducts or something similar had been used. Wiring for motors or lights in the stations should all be carried out with screwed conduit, well earthed, and kept quite clear of lead-covered cables if any such are present.

To avoid any possibility of the station being thrown into complete darkness, it should be lighted by two distinct systems. If the station supplies both lighting and traction, a lighting circuit should be taken from the traction supply as well as from the lighting supply.

The motors used in the works should not have circuit-breakers in circuit with them, but clip copper wire fuses fitted with a porcelain handle and shield for protecting the hand. The fuse should be visible, so that the attendant can see if it is getting hot, and plug in another fuse in parallel if he thinks it at all safe to do so. This arrangement would often allow of a motor being kept going during heavy loads, and also permits of a fuse being withdrawn and renewed if necessary without stopping the motor.

Efficient means of extinguishing fires should be conveniently situated in every station. Water is out of the question, as it could only be used after all current was cut off. Non-inflammable non-metallic buckets of sand should be placed on the switchboard gallery. Chemical fire extinguishers should be placed at convenient points throughout the works, and care should be taken to see that they are not mere toys but efficient fire extinguishers. The floor round the switchboard may be of wood, treated in such a manner as to render it non-inflammable. The writer has seen such a floor turn black with the heat without catching fire.

Red signal lamps should be fixed in prominent positions in each room of the station, and switched on from the switchboard. The shift engineer or superintendent can

thus be quickly summoned in case of accident, wherever he may be at the time.

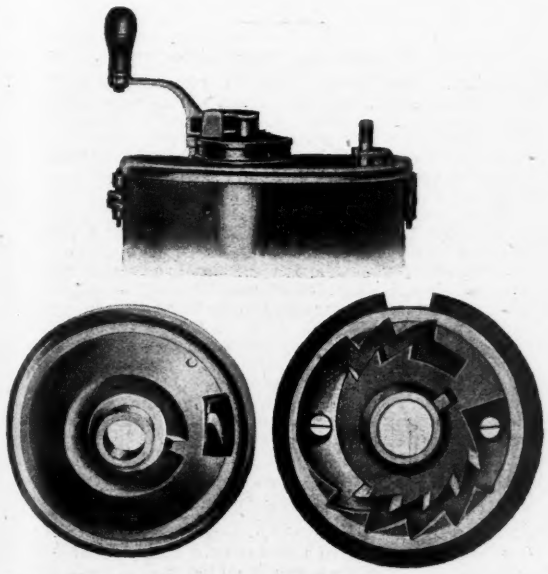
The writer is of the opinion that traction feeders are the only ones that should be fitted with maximum current circuit-breakers. Generators and balancers should be either fitted with fuses blowing at a considerable overload, or, better still, with some kind of carbon-break switch-fuse similar to the type described recently in this paper as part of the equipment at the new Birmingham station. These act in a similar manner to a maximum circuit-breaker fitted with a time relay, and the first cost is or should be much less.

Lastly, the switchboard attendant should be supplied with an up-to-date, accurate diagram of all connections, and encouraged to get a thorough understanding of every operation he has to perform. He should also study what would happen in the event of any accident occurring, and decide beforehand what he would do in each emergency. This would help to prevent him from losing his head at critical moments and doing reckless things, causing great damage. The subject of this article is a very important one, and whilst nothing new has been brought forward, still, attention may have been drawn to some points that have not received sufficient notice in some central stations.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The Barrett Controller Regulator.

The Electrical Apparatus Co., of Caxton House, S.W., are introducing an extremely ingenious device for the prevention of improper acceleration of electric cars. It consists of a stationary iron plate, which is attached to the controller cap, and is provided with camming and arresting teeth; an iron cover which, when placed in position, locks with the stationary plate; and a heavy tool-steel pawl which is actuated by gravity, and adapted to engage the teeth of the stationary member for a brief interval at each "point," as the controller handle is advanced in applying the current. The arrangement is such that the pawl is guided by the inner star wheel, so as to engage successively the teeth of the outer one, checking the motion of the handle with certainty; but the moment the



Barrett Controller Regulator, in Position and Dismounted.

forward pressure on the handle is relaxed, the pawl falls free, and the handle can be further rotated, step by step. On the return journey the pawl offers no hindrance to the motion, and the controller handle can be returned to the "off" position instantly.

The simplicity of the regulator is well shown in the accompanying illustrations. There are but three parts; there is nothing to get out of order, and lubrication is unnecessary. The device will wear indefinitely.

By compelling the motorman to stop for an instant on each point of the controller, and consequently limiting the accelerating current and the arc which has to be broken each time the handle is advanced a step, the burning and pitting of controller fingers are avoided. The adoption of the regulator is accompanied by a distinct improvement of the load curve, as the sudden rushes of current necessarily accompanying improper acceleration are rendered impossible.

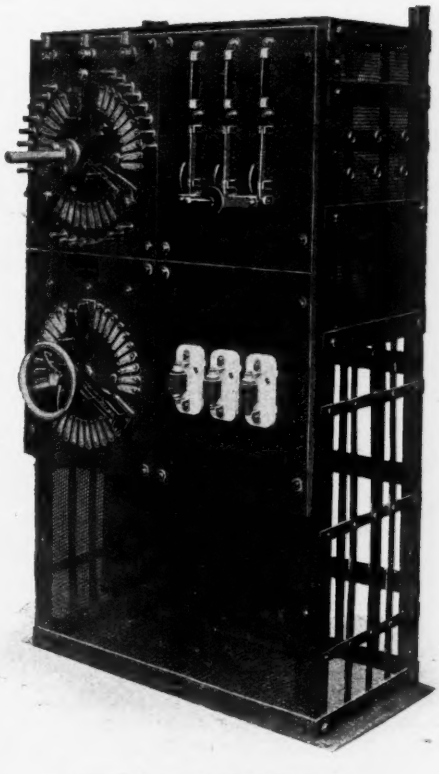
Samuel's Patent Drawing Pen.

Draughtsmen, who have for years suffered from the inconveniences of the ordinary drawing pen, will welcome this instrument, which is being supplied by the Union Drawing Office, St. Vincent Street, Glasgow.

It consists of a pen of ordinary type, provided with an arrangement which permits of the instant opening of the pen for cleaning, and its reclosing without altering the adjustment, so that the trouble of setting the pen to the original width of line, more or less accurately, is obviated. Further, a steel nib is provided, which encloses the points at the sides, without hindering the adjustment of the movable point, and thus retains the ink and prevents its evaporation. By this means, we are informed, it is made possible to use a pen on fine line work for hours without cleaning or refilling. The pen can be used without the nib if desired. Only those who have spent years at the drawing or tracing board can appreciate the comfort thus obtained.

A Large Lift Controller.

The Adams Manufacturing Co., Ltd., send us a photograph of a large 35-h.p. lift controller recently installed at the Hartford Works, Oldham. The lift is operated by a neat, compact switch in the car, which uses the least number of control wires. For stopping the lift at the two limits of travel under any circumstances a limit switch is provided, which is actuated by the movement of the car. The controller proper comprises a suitable self-starter, main line switch, reverse switch, magnetic brake solenoid, and relays. The self-starter is of the multiple solenoid type, which consists of a number of contactors for controlling the different steps of the starting resistance, in turn controlled by a master



Adams 35-h.p. Lift Controller.

self-starter which provides very smooth and even acceleration under all loads. For absolute safety and reliability the controller is made "double-pole," both sides of the line being disconnected from the motor in the "off" position of the controller.

Both sides of the self-starter solenoid coil are also disconnected from the lines, ensuring the quick return of the self-starter to the starting position.

The controller is arranged to control a suitable solenoid for releasing the mechanical brake, and provision is made for disconnecting both sides of the line from the winding of the brake solenoid. This ensures the quick and positive application of the brake in the "off" position of the controller, and prevents its action being interfered with by any inductive effects from other portions of the installation.

To provide for positive control of the lift from the car, the system of control has been so designed that all the wires leading

from the switch in the car to the limit switch and controller proper are of the same polarity, so that there is no tendency for leakage currents or short circuits in the control cable. The controller includes an automatic no-voltage device and time-limit overload preventer.

All main circuit breaking points are reinforced by carbon contacts and powerful magnetic blow-outs.

The main line switch and reversing switch are interlocked to cause co-operation of these parts, and they are, in addition, interlocked with the self-starter, so that it is impossible to close the circuit to start the motor until all of the starting resistance is in circuit.

Control Switch in Car.

This particular controller is designed to ensure constant speed in the running of the lift, and only one speed is available. Very often, however, two speeds are desirable, especially in a quick-running lift, as the operator is thus enabled to slow the car down very quickly under all conditions of load, which materially assists him in making quick and accurate stops. Controllers of the type illustrated can be provided with two or more speeds if necessary, and this speed control is obtained entirely by shunt field resistance under the control of the operator in the car, so that he can not only use the lower speeds to assist him in stopping, but can also run continuously at any one of the available speeds whenever he desires.

New Patent Jointing Sleeve.

While the best cover for a straight-through joint on a lead-covered high-tension cable is admittedly a lead sleeve with wiped joints, it is difficult to get an ordinary jointer to make a neat and satisfactory job of it, so that frequently the cheaper and more easily fixed cast-iron joint box is used. Messrs. W. T. Glover and Co., Ltd., of Trafford Park, have now brought out a new patent lead sleeve which, they claim, combines the simplicity and cheapness of the cast-iron box with the efficiency of the plumbed lead sleeve.

In the ordinary process of applying the latter, a piece of lead pipe, commonly known in the trade as "soil pipe," is first taken, cut to the required length, and beaten or worked down at one end to fit over the lead on the cable, in the manner shown in fig. 1. In the case of very large and heavy cables, these sleeves have to be formed from sheet lead, at an even greater cost than those made from the soil pipe. After the ends of the cable have been jointed together the sleeve is drawn over the joint, and the open end beaten or worked down until it also fits over the lead on the cable, as shown in fig 2. The ends are united with the sheathing by wiped joints, and the sleeve is then filled with compound through two brass plugs or tap screws, which have been previously fitted into the sleeve and are shown in fig. 1. The joint is now complete.

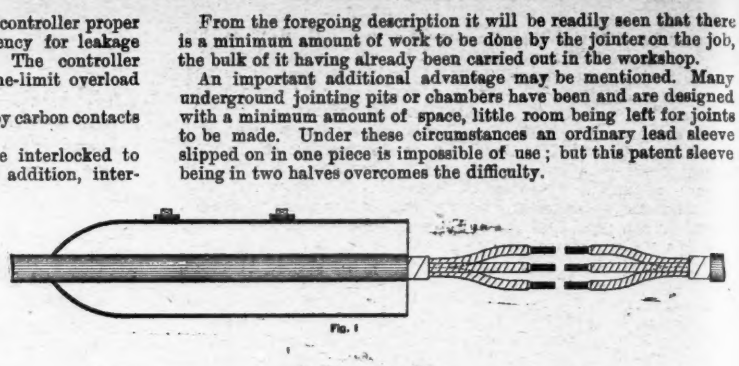
According to the new method, a lead sleeve is moulded or cast to the exact size and shape required, but in halves. Each half of this sleeve is placed in position, one on either end of the two cables to be joined together, as shown in figs. 3 and 4. After the ends of the cables have been jointed, the two halves of the sleeve are screwed firmly together, as shown in fig. 5. The small projecting flange A is now beaten over the flange B, making a perfectly solid joint, and if it is thought necessary a small amount of solder may be wiped into the recess as shown at C (fig. 5).

The joint is completed by plumbing the ends of the sleeve to the lead covering of the cable in the ordinary manner.

D D D are strengthening rings or ribs, which may either be cast as simple projections on the lead, or metal rings such as iron, or brass, may be cast or moulded into the body of the sleeve as shown.

From the foregoing description it will be readily seen that there is a minimum amount of work to be done by the jointer on the job, the bulk of it having already been carried out in the workshop.

An important additional advantage may be mentioned. Many underground jointing pits or chambers have been and are designed with a minimum amount of space, little room being left for joints to be made. Under these circumstances an ordinary lead sleeve slipped on in one piece is impossible of use; but this patent sleeve being in two halves overcomes the difficulty.



Glover's Patent Jointing Sleeve.

The sleeves can be supplied in all sizes from 2 in. to 5 in. in diameter. A number of moulds have been stocked, and as the sleeves are ready for use five minutes after casting, they can be obtained at a few hours' notice.

LEGAL.

Carl Oppermann Electric Carriage Co.

Before Mr. Justice Parker, in the Chancery Division on Friday, Mr. Buckmaster, K.C., moved on behalf of the executors of Mr. Hy. Brown, the plaintiff, in a debenture-holder's action against the above company, to set aside an order which had been obtained *ex parte* by Mr. Oppermann, and under which he had obtained the conduct of the proceedings. Mr. Brown had commenced the action in February, 1905, suing on behalf of himself and all other debenture-holders. A receiver had been appointed, and judgment had been given. Mr. Brown held £2,624 debentures and Mr. Oppermann £1,049. As far as one could make out, Mr. Oppermann's reason for wanting the conduct of the action was that he desired to carry out an offer for sale which the Master himself had declined. He took out a summons in December last, and made an affidavit, to which Mr. Brown replied, but the latter died on January 2nd. It seemed to have occurred to Mr. Oppermann and his ingenious advisers that this provided an opportunity of being substituted for Mr. Brown as plaintiff, in which he would probably not have succeeded on his summons, and accordingly, barely allowing time for the funeral, and with no notice at all to the executors, he obtained the *ex parte* order, which it was now sought to discharge.

Mr. Romer, K.C., on behalf of other debenture-holders, supported the motion.

Mr. Tomlin, for the company, said the order had not been obtained with a view of taking an unfair advantage of anybody, and he contended that there was no necessity to give notice.

It was ultimately agreed that the order should be discharged, and the merits of the case gone into on the original summons, the costs of the motion being reserved.

Grundy *v.* Smith.

In the King's Bench Division on Friday, February 1st, before Mr. Justice Phillimore, Sydney Samuel Grundy, of the Parade, East Moseley, electrical engineer, trading under the name of Grundy & Crombs, sued Walter Raynes Smith, of 4, Park View, Thames Ditton, for £145, alleged to be due on a bill of exchange and £55 money advanced.

Mr. Woodcock represented the plaintiff, and defendant appeared in person.

Plaintiff's case was that he employed the defendant as his traveller between February and October, 1905. During that time he advanced the defendant £72 18s. 6d., and the commission earned amounted to £13 15s. 6d. In August, defendant told him he had obtained the contract to provide electrical appliances for 200 houses being built, by a Mr. John Curtis. The commission on that would have amounted to £435, and on September 11th plaintiff agreed to accept a bill drawn upon him for £200, less £55, the amount of unpaid advances. Later, plaintiff discovered that defendant had never actually secured the contract, and he stopped the bill at the bank. Defendant, however, succeeded in negotiating it with a Mr. Williamson in December.

Defendant went into the witness-box and swore that at the suggestion of Curtis he (defendant) took an estimate to his house; Curtis told him it was the lowest of the three he had received. The next day he wrote confirming the order. When he told plaintiff it was impossible for him to continue with him, he suggested that he should advance him £20 or £30, but he could only give him £10 on account, and afterwards small sums from time to time. Plaintiff made no difficulty about giving him the bill. Defendant suggested that when plaintiff realised what a large contract it was, he arranged with Mr. Curtis to revise the estimate, which thus became higher than their competitors' prices.

Plaintiff, recalled, admitted that the estimate was raised between August 30th and October 4th, and stated that Curtis did not accept it.

Cross-examined, Defendant said his brother gave him £10 for the bill, and was to pay him the balance by instalments.

Judgment was given for the plaintiff for £55 and costs, with an indemnity against the bill.

Collision with a Tramway Pole.

A question of some importance, involving the liability of local authorities for street obstructions caused by the standards erected to carry electric wires, arose in a case tried at the Manchester Assizes last week, before Mr. Justice A. T. Lawrence and a special jury. The plaintiffs in the case were Messrs. David Moseley and Sons, a well-known firm of india-rubber manufacturers, and they claimed damages from the Manchester Corporation for injury to a motor-car. The Corporation denied their liability, and also pleaded contributory negligence. Counsel in the case were, for the plaintiffs, Mr. Tobin, K.C., and Mr. J. H. Layton; and for the defendants Mr. Shee, K.C., and Mr. Rhodes.

The plaintiffs' private car was being driven along the high road from Middleton to Manchester about midnight on July 13th by Mr. Reginald Moseley, when it collided with a standard which was fixed in the middle of the roadway at Cheethsm Hill, causing damage to the car amounting to £116.

It appeared that for a great part of the way between Middleton and Manchester the standards which carry the tramway trolley wires are in couples—one on each side of the road—but that, on approaching Cheetham Hill, the system changes to a series of single standards, which run along the centre of the roadway. There was, according to the plaintiffs' evidence, at the time of the accident, no light attached to the first standard of the series to warn drivers of vehicles of possible danger.

After Mr. Moseley had given evidence, the Judge, in summing up, said the plaintiffs could only recover if negligence was proved, and the jury had to be satisfied, before finding the Corporation liable, that they had not exercised reasonable care in ensuring the safety of the public. The Corporation had a statutory right to place the standards where they were. Was this one properly lighted? If it was not, and the accident occurred in consequence, they would be liable, provided the driver exercised due care.

The jury found for the plaintiffs for the amount claimed.

Defendants' Counsel asked for a stay of execution with a view to appeal.

His Lordship granted a stay for 14 days on the usual terms.

An Ingenious Meter Fraud.

At the Penarth Police Court on January 28th, a jeweller was charged with fraudulently using electricity, the property of the Penarth Electric Lighting Co. It appeared that the consumer had by some means got the name plate off a Geipel & Lange slot meter, and through one of the rivet holes, where the name plate had been attached, he inserted a thin wire, which prevented the armature of the meter from working, with the result that after putting in a penny, he could keep his lights going without putting in any more coins so long as he kept the wire inserted. A fine of £5 was imposed.

Electric Signs.

Before Mr. Justice Parker, in the Chancery Division on Friday, Mr. Gordon mentioned the actions of Hinton *v.* The Electric Signs and General Advertising Co. and Hinton *v.* The Electrical Name and Numerical Sign Co., in which he had given notices of motions for interim injunctions. The plaintiff had a patent relating to the illumination of luminous signs, and there was a conflict of evidence on the issue of infringement which he thought could not be gone into on a motion.

It was agreed that there should be no order on the motion except that the costs should be costs in the cause.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Engineering Apprenticeship.

Premium paying is one of those unfair business transactions that, in time, must most surely be done away with. It is entirely a one-sided contract, the only gainer in 99 per cent. of the cases being the employer's pocket.

Whichever way one looks at it, the employer receives far more than ever he deserves; if the apprentice proves to be a worker, he is at the end of six months a source of profit, and during the last years of his apprenticeship is doing work that other men are paid full wages for; if, on the other hand, the youth is inclined to idle, he is allowed to, his firm saying to themselves, "Well, if he cares to waste his time and money we cannot help it, it is no loss to us." If, now, taking the same case, no premium had been paid, he would be made to work, or his indentures would be cancelled; this would either wake the youngster up and put sense in his head, or else it would make him turn to some other profession.

Again, in the majority of cases, the actual men who have the handling of the apprentice derive no benefit from the premium, and unless the parents are able to pay another premium in the shape of "palm oil," do not bother their heads much about the youngster, the result being that, most likely months are wasted on repetition work and running errands.

As long as parents are willing—nay, anxious—to supply those firms with capital and free labour, so long will the evil exist. The demand for apprentices, or, in other words, cheap labour, will not greatly decrease when this premium system is abolished, the remedy is to a great extent in the hands of the public—let them move.

There are, of course, exceptions to every rule, and the exception to this is in cases where the chiefs themselves devote certain time to the pupils' training, such as in central stations, or in works where the pupil is only sent to obtain a general knowledge or outline. These cases come more under the heading of private tuition or college training.

Premiums are practically an unknown quantity out of this country, and, also, I believe in the rest of the Colonies, the different Governments and firms realising that they obtain ample payment from the work they obtain.

Douglas A. C. Bailey.

Cape Colony, *January 14th*, 1907.

[It must in justice be pointed out that a great improvement has taken place in this connection in recent years.—Eds. E.R.]

Shift Engineers.

The side issue which your correspondent "One Who Storms" raises in your January 25th number, is a complaint that is not unusually made by those who, through no fault of their own, have been unable to get the recognised training for any position. Apparently your correspondent expects a works manager to give a young man an opening, for very much the same reason that a judge was once asked to pass a light sentence on a wife-beater, viz., because he was good to his mother.

We are all fighters in an industrial civil war, and chief engineers can afford to give no quarter and take no risks, and hard as it is for an able but unsuitably trained man to find his progress barred, it would be harder still for an industry were its captains to listen to the voice of love rather than the dictates of reason.

I regret, too, your correspondent's sneer at "My Lord Pupil," and would point out that poverty is not necessarily a sign of ability, nor riches of incapacity. With a large and long experience of the pupil, I must say that I have noticed that whilst his wealth has no doubt brought him opportunities

not open to his unportioned rival, it has also laid him open to distractions which have seriously discounted the advantages it afforded.

Sympathiser.

Trade Prices.

In the interest of the trade, I think it advisable to call your attention to a practice which will, probably, be detrimental to trade interests.

I have just received from a firm in Birmingham, a large-sized postcard illustrating many of the accessories in daily use in the electrical engineering business, and I was exceedingly surprised to find they had marked thereon in large plain figures the wholesale prices of the articles. This will mean that many people in the offices to which these are sent, and also in the post office, will be informed of the wholesale prices on these various articles, whereas wholesale prices should, in the interest of the trade generally, be kept strictly private only.

I have written the firm in question, telling them that there is nothing more harmful than letting wholesale prices become public property.

R. A. W. Lance.

Llandudno, *January 29th*, 1907.

Electric Clock Installations.

Referring to the suggestion in your long notice of the electric clock installation at the Liverpool Cotton Exchange, that the 120 electric dials fitted there, form the largest installation in this country. This is far from the case, and it may interest your readers from a technical point of view, to know that the Magneta installation in the new Ritz Hotel, Piccadilly, nearly reaches double this number. This building is installed throughout its seven floors with some 200 Magneta dials, which, as described in the report of Sir William H. Preece, are actuated without batteries or contacts.

It would be out of place here to give a list of some of our large installations, but it may be mentioned that some erected under Government contracts entrusted to us are, as regards the number of units, quite as large as that at the Ritz Hotel.

For **The Magneta Co.**
W. J. Polyblank,
Assistant Managing Engineer.

London, E.C., *January 30th*, 1907.

Electricity and Destructor Works.

I merely wish to point out that the figures for the Partick destructor in the above article [Electrical Review, February 1st] are quite incorrect, as the actual labour cost in the destructor for the last completed year is 1s. 3½d. per ton, not 2s. 0½d. per ton, and the total salaries and wages in the department, including a proportion of my salary and of clerical wages, and including the cost of disposing of the clinker, are only 1s. 11¼d. per ton. The cost for repairs and maintenance during this period was 1¼d. per ton. Also, we made a profit of ¼d. per ton on the clinker disposal, so that nothing should be included for this item.

H. B. Maxwell,
Burgh Electrical Engineer.

Electricity Works, Partick,
February 2nd, 1907.

The Cramp Neutralised Repulsion Motor.

I have read carefully Mr. Fynn's letter in your issue of January 31st. In reply to his charge of unfairness, I can only say that the meeting was well advertised, and that instructions were given for an advance copy of the paper to be forwarded to him. I am sorry that he did not apparently receive this, and that he was not present at the discussion.

Mr. Fynn's expression, "got conveniently short-circuited," and his other personal charges, I can afford to pass over. Any reader can see that such phrases tell more against him than against me.

Now, as to the theory of the machine; I gave a full phase diagram in the Electrical Review of May 11th, 1906, with which Mr. Fynn was not satisfied. I have now given in my Manchester paper a circle diagram and an explanation, which seem to me to clear up the matter entirely. I do not see what more I can do to satisfy my critic. It is clear that our main point of difference is the magnitude and phase of the flux called by Mr. Fynn ϕ_m. Of the components of this flux ϕ' and ϕ_2, I make ϕ_2 the greater; while Mr. Fynn says, "In any case ϕ' will always be by far the greater component of ϕ_m." It is unfortunate for Mr. Fynn's view that in the very first motor I am able to obtain a ratio of $\phi_2 : \phi' = 3 : 1$.

William Cramp.

Manchester, *February 2nd*, 1907.

Metallic Filament Lamps.

I am interested in the letter appearing in this week's Review from Mr. R. N. Cunningham, giving his experience of running the Osram lamp against one of the best carbon lamps. The difference in cost seems so great, that I can hardly understand why the Osram lamp does not totally displace all carbon filament lamps up to this voltage.

May I ask was a separate meter used for each window, so that each batch of lamps was actually metered for their current consumption, or was this arrived at from the lamp markings?

Was the candle-power equal in each window as far as general illumination of the window was concerned, or was the candle-power also taken from the ratings?

The Ediswan lamps I have sold, of 100 volts, have a much higher efficiency than 4 watts, which is what Mr. Cunningham's batch works out at; I also find they have a far longer useful life than 500 hours if the pressure is fairly normal.

I shall be much obliged if Mr. Cunningham will very kindly give a little more information *re* these points, as we are all interested to-day in getting facts for our clients. I, for one, want to put forward no statement that may be called exaggerated—our gas friends do quite enough of this, here, at any rate.

W. M. Horsfall.

Liverpool, *January 29th*, 1907.

Obviously the problem to be solved is to produce a metallic filament lamp of moderate candle-power, capable of being run singly on 200-250-volt circuits.

Until this can be done, why not make a composite lamp containing a carbon filament in series with a metallic filament?

For instance, a 100-volt tantalum lamp (1·7 watts per c.p.) takes ·35 ampere and gives 21 c.p.

A carbon lamp 100 volts (3·5 watts per c.p.) takes ·35 ampere and gives 10 c.p.

Now if this carbon filament were disposed inside the tantalum lamp, we should get a lamp giving 31 c.p. and taking ·35 ampere at 200 volts, or only 70 watts and an efficiency of 2·25 watts per c.p.

Surely such a lamp as this would be just the thing to take the place of the ordinary 16-c.p. lamp, and add another nail to the coffin of "our friends the enemy."

With osram lamps the "combined efficiency," if I may coin such a term, would be still higher than 2·25, but there would be more difficulty in "stowing away" the carbon filament; but it seems to a mere outsider like myself that there would be plenty of room inside a tantalum lamp—for instance, the carbon filament might be circular, and be mounted concentrically with the glass rod at the cap end of the lamp.

Inquirer.

I was much interested in the letter over the signature of Mr. R. N. Cunningham in your issue of the Jan. 25th where he expresses his regret at being unable to give the members of the Institution the benefit of his experience. Through your courtesy he has been enabled to present

them, but in such form that it is impossible to arrive at anything like accurate results from the meagre information vouchsafed.

In your issue of January 25th it is stated that for a 500 hours' test the efficiency of the Ediswan lamp averaged but little more than 3½ watts per C.P. Mr. Cunningham assumes, for he apparently has done nothing else, 3·9 watts per C.P., a figure largely in excess of that given for an actual test by the Westminster Testing Laboratory.

It would be interesting to know if the two windows referred to were supplied through separate meters, properly calibrated, and whether photometric tests were taken at the beginning and end of the test, or, as is more likely, were all the lamps supplied through one meter, the hours estimated, and the candle-power obtained from the catalogues of the manufacturers.

John Hewitt.

London, E.C., *January 30th*, 1907.

If "Nothing Like Leather" will come out of his "skin" and divulge his identity, I shall have much pleasure in replying, with legal assistance or otherwise, to his query.

Horace Boot,
Consulting Engineer and General Manager.

Tunbridge Wells,
February 4th, 1907.

The New Prevention of Corruption Act.

. . . . Could you not specify for its use on your installations? I told him that I very rarely, indeed, specified any manufacturer's name in a specification, and only did so when it was absolutely necessary.—ELECTRICAL REVIEW, January 4th, 1907.

I have before me a specification [illegible] pages to-day.

Admiralty Distribution Boxes.—We are informed that switches made by the CANTIE SWITCH MANUFACTURING CO., of Mount Street, Nottingham, have been specified for these.

Advance in Prices.—THE ARMORDUCT MANUFACTURING CO., LTD., announce that further substantial metal advances compel them to reduce the trade discount applicable to close joint conduit to 25 per cent. This alteration came into force on February 1st.

Catalogues and Lists.—ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., Aston, Birmingham.—Illustrated sheet No. L30, showing a complete range of self-contained portable electric drills (the "Midget," the "Slick" and the "Runthru") and drilling pillars for use in connection with them. The cases are of cast aluminium, and the drills are as light as is compatible with high efficiency. By the addition of suitable fittings, these machines can be adapted for tapping, reamering and sawing, as well as drilling.

MESSRS. REID BROS., 12, Wharf Road, City Road, N.—32-p. illustrated pamphlet, giving full information concerning their pneumatic tubes, and views of important buildings which are equipped with them.

MESSRS. OFFORD & CO., 97-98 Woodcock Street, Birmingham.—

tinually being cut off and gas reinstalled, and several places where the electric light is installed and not used, but *gas* in preference. And why? Because of heavy bills, bad light, and series of small troubles, causing a great inconvenience to the consumers.

"How is it that my bill is so much heavier than it was for the corresponding quarter last year? I have used no more light." Can any cashier connected with electricity supply conscientiously say that he has never had a like question put to him?

This generally results in having the meter tested, lamps changed, &c., but still heavy bills. The consumer gets annoyed by the continual trouble and expense, and discards electricity. Now, what is the root of this evil but jerry wiring (exceptions admitted)?

I am quite aware that if it was expected that the chief engineer should personally supervise all the many minor branches, he would be a busy man indeed. But he has, or should have, a full staff of properly appointed assistants.

As far as I can see, the consumer blames electricity; the trade, cheap labour; the contractor, competition; the assistant, his chief; and the chief, the Lighting Committee.

S. Fraser.

London, S.E., *February 4th*, 1907.

Wireless Telegraphy and the Admiralty Contract.

"Your Correspondent" has quite fulfilled my expectations of his sense of decency in controversy. He knows he is wrong, and instead of admitting it and apologising for the repeated misstatements in his letter of last week, he once more endeavours to confuse the issue in a mass of verbiage—a fact which anyone who has read the correspondence on this subject must, I think, realise.

He stated:—"It" (*i.e.*, the Admiralty) "is still under agreement with the Marconi Co. in certain respects; but it is not compelled to purchase any more apparatus from that company except jiggers and trays of Leyden jars."

This was "Your Correspondent's" statement of the position between the Admiralty and the Marconi Co. at the time of his communication.

I denied in the following terms that that statement correctly described our position:—"It is incorrect to say that the Admiralty 'is not compelled to purchase any more apparatus from the Marconi Co., except jiggers and trays of Leyden jars.' There is other wireless apparatus which is not at the disposal of the Admiralty unless purchased from the Marconi Co."

That is the issue; a very simple one; that and nothing more. Whether the Admiralty is bound to purchase only from our company apparatus other than jiggers and Leyden jars.

However much "Your Correspondent" may write, and whatever he may write, that issue will remain unchanged.

In support of his original statement, (1) he adduced the Admiralty contract of 1903, and (2) asserted that he would not have made this statement had it not been "confirmed by someone in authority at the Admiralty."

The Admiralty contract of 1903 does not prove and does not represent the present obligations of the Admiralty to the Marconi Co. in their entirety. "Your Correspondent" was not writing of 1903, but of the present time. He wrote:—"The Admiralty *is* still under agreement with the Marconi Co. in certain respects, but it *is* not compelled to purchase any more apparatus from that company except jiggers and Leyden jars."

That statement was incorrect, and "Your Correspondent" still owes an apology for it, and even more for his subsequent reassertions of it.

Apparently, however, the Admiralty contract of 1903 was not considered sufficient evidence, even by him, of his statement of the present obligations of the Admiralty towards the Marconi Co. His statement of these obligations was "confirmed by someone in authority in the Admiralty." There is no one in authority in the Admiralty who will confirm his statement, and no one in authority in the Admiralty who will deny mine.

As managing director of the Marconi Co., I signed my name to my statement, and the Admiralty, the other party cannot, and does not, deny it.

"Your Correspondent" gives no evidence of being in a position to express an authoritative opinion on the subject in question, he dare not even sign his name to his statements. He made the original statement that the Admiralty is not compelled to purchase any more apparatus from the Marconi Co. except jiggers and Leyden jars—anonymously, not even with the weight of a name to it, however obscure and insignificant in this connection.

I say over my own signature that the Admiralty has bought from our company some thousands of pounds worth of apparatus other than jiggers and jars, which it was, and is, under legal obligation to buy from no one else.

Let anyone deny that who can, whose denial has any value. "Your Correspondent's" has none—not even over his own signature, which he dare not append. The onus of proof rests with him, and he cannot adduce any proof.

"Your Correspondent" suggests that I should prove my statement by producing the contract under which the Admiralty is compelled to purchase from our company apparatus other than jiggers and jars. If there were any obligation to respond to a suggestion of this kind, anyone would be at the mercy of the idle curiosity of every anonymous writer. Moreover, "Your Correspondent" has other sources of information; he knows "someone in authority in the Admiralty," someone who has been good enough to confirm his original incorrect statement; why not go to the

fountain-head once more? Information from "someone in authority in the Admiralty" must be worth more to "Your Correspondent" than my version of a contract.

However, if "Your Correspondent" will admit his identity, I will consider whether I will show him documentary evidence of what I have stated; but "Your Correspondent" knows better than to do this. People who take advantage of anonymity to make untrue statements, do not surrender the protection of their anonymity when their falsity is demonstrated.

Marconi's Wireless Telegraph Co., Ltd.,
H. Cuthbert Hall, *Managing Director.*

London, E.C., *February 5th*, 1907.

The Lighting of Oxford Street.

In your note on this subject in your issue of the 25th ult., the statement is made that the cost of the 81 arc lamps now used for lighting Oxford Street, at £20 13s. 7d. per lamp per annum, works out at "a total for the whole lighting exactly equal to that of the previous inferior gas lighting."

As I am confident that you desire only to give your readers accurate information, I should like to correct this statement.

The charge for the 81 arc lamps amounts to £1,675 per annum. The cost of the previous gas lighting was one-third of this amount, approximately £550 per annum.

The estimated annual cost of lighting Oxford Street by modern gas lamps, according to the scheme submitted by my company and pronounced by the Council's Lighting Committee, after prolonged and careful inquiry, to be preferable to the electric lighting scheme since adopted, was £1,680. The Electricity Committee fixed their present rate of charge after this company's quotation had been made public. Their original estimate was £110 higher. The estimate for gas provided for all lamps alight all night. Nearly one-half of the arc lamps are extinguished at 12.30 a.m. A similar arrangement with gas would have reduced the cost nearly £200 per annum.

The installation cost of the arc lamps was estimated at over £3,400, with an additional £3,000 for mains. The inclusive estimate for gas was well under £2,000.

The decision to adopt electric lighting was arrived at by the Borough Council—in the face of the recommendation of its Lighting Committee in favour of gas as being more economical and more efficient—solely on the question of "loyalty" to their own undertaking. The borough is, consequently, sacrificing some hundreds a year in order to make a profit (?) on the sale of about £900 worth of current.

It is as well that these facts should be put on record for your readers, lest the statements made in your "Notes," under a misapprehension, should lead them into misleading others and coming to grief on being faced with the truth.

F. W. Goodenough,
Chief Inspector.

The Gas Light and Coke Co.,
London, S.W., *February 1st*, 1907.

[The note in question was received from an official source, but obviously the word "previous" should have been "proposed." We understand that the ordinary rates of charge are in force for this service, and taking into account its excellent character and the necessity of good lighting, the installation cost appears to be justified.—Eds. E.R.]

Jacks for Tramcars.—The Board of Trade recently addressed a letter to the Tramways and Light Railways Association referring to the Board's letter of November 16th last year, relating to Col. Yorke's recommendation that lifting jacks should be provided at depôts and elsewhere, and asking whether the association had obtained any information as to the practice adopted in various localities in this connection. The association last month passed a resolution concurring with the recommendation, and instructed the secretary to communicate with the various tramway undertakings in the country with a view to obtaining the necessary information required by the Board of Trade. It appears that it is not only Government departments which are slow to take action.

BUSINESS NOTES.

The Next Engineering Exhibition at Olympia.—In connection with the forthcoming Engineering and Machinery Exhibition at Olympia, from September 19th to October 19th next inclusive, the inaugural meeting of the Hon. Advisory Council was held last week at the Holborn Restaurant. Mr. Edgar Worthington, B.Sc., who was chairman of the Advisory Council of the 1906 Engineering and Machinery Exhibition, was unanimously elected chairman of the Hon. Advisory Council. The list of patrons as submitted, which includes the names of a large number of leading men in every branch of engineering and the representatives in this country of many foreign interests, who have signified their willingness to act, was formally accepted. The committee also decided to add to the list any influential names which might be suggested in the near future. The question of local committees in various industrial centres was next gone into. It was explained by Mr. Smith, one of the organising managers of the Exhibition, in reply to various questions from members of the Council, that the object of the local committees was to enable the Council to keep in touch with the various local engineering centres, the districts suggested being Glasgow, Newcastle, Manchester, Leeds, Birmingham, Cardiff and Ipswich. It was eventually decided to form committees in the centres named and in other districts as opportunity offered, and further, that the chairmen of the local committees should be *ex-officio* members of the Hon. Advisory Council. The selection of the said local committees was to be left in the hands of the organising managers and chairman. It was decided to appoint various sub-committees to superintend departments dealing with educational matters and lectures, loans, inventions, and receptions, and upon a vote being taken with regard to the acceptance of inventions, it was decided that this section should be thrown open to all parts of the world subject to the conditions affecting Exhibitions as laid down by the Board of Trade. The Council approved, with some minor alterations, the prospectus to be issued. In answer to some remarks made by Mr. Lovell in reference to electric installations on stands at the show, it was explained that there was no question of monopoly, and that exhibitors would be at liberty to employ any properly qualified electrician for the purpose of fitting up their exhibits, subject to the approval of the New Olympia [illegible] electrical engineers.

Cunningham's batch works out at; I also find they have a far longer useful life than 500 hours if the pressure is fairly normal.

I shall be much obliged if Mr. Cunningham will very kindly give a little more information *re* these points, as we are all interested to-day in getting facts for our clients. I, for one, want to put forward no statement that may be called exaggerated—our gas friends do quite enough of this, here, at any rate.

W. M. Horsfall.

Liverpool, *January 29th*, 1907.

Obviously the problem to be solved is to produce a metallic filament lamp of moderate candle-power, capable of being run singly on 200-250-volt circuits.

Until this can be done, why not make a composite lamp containing a carbon filament in series with a metallic filament?

For instance, a 100-volt tantalum lamp (1·7 watts per [illegible] *Électrique, Électro-thérapique et Radiographique.* By Dr. Foveau de Courmelles. Paris: Ch. Béranger. 1907. Price 3.50 fr. —This annual review forms a useful summary of electrical progress during 1906, and is now in its seventh year. It culls information from a wide field, and condenses it into small space, without illustrations. The binding and paper are of the cheap quality frequently met with in French publications, with paper covers, but the printing is good.

Fowler's Mechanical Engineer's Pocket-Book, 1907. Edited by W. H. Fowler. Manchester: Scientific Publishing Co. Price 1s. 6d. net.—This familiar pocket-book has undergone the usual overhauling and extension, to bring it into line with recent developments, especially in connection with steam turbines and internal combustion engines. There is a vast amount of information on engineering subjects in the book, which is one of the best of its kind.

The Engineering Index. Vol. IV. 1901-1905. Edited by H. H. Supplee and J. H. Cuntz, with C. B. Going. London: *The Engineering Magazine.* 1906. Price 30s. net.—*The Engineering Index* has now been published since 1884; the last volume appeared in 1901, and though the monthly instalments of the Index are included in the successive issues of the *Engineering Magazine*, they are necessarily not in a convenient form for reference, and we are therefore very pleased to notice that in future the volumes will be published annually. We have on previous occasions borne witness to the great value and utility of this excellent publication, which should be found in every engineer's reference library. The present volume contains over 50,000 entries, and cross-references have been freely used, so that the search for information on any particular subject is greatly facilitated. The periodicals indexed number 250, in six languages, though only one-fourth of the periodicals are published in languages other than English. Very full instruc-

tions are given for the guidance of the user; these are very necessary, for it is essential to understand the plan of the work in order to obtain the greatest benefit from its contents. However, the plan is simple enough; the aim has been to select such catchwords as are most likely to be consulted by the searcher in pursuit of any particular class of information, and to guide him as directly as possible onwards to his goal. Our experience of previous volumes has led us to look forward, during several years past, to the appearance of the present one, and we tender it a most cordial welcome, in the sure hope of improving our acquaintance with it in the future.

The Central. Vol. III, Dec., 1906.—The new issue has for frontispiece a portrait of Prof. Armstrong; it contains a well-illustrated article on the Witton Carbon Works of the General Electric Co., Ltd., by Mr. M. Solomon, describing in detail the processes of carbon making and the qualities which arc lamp carbons must possess. There is also an article on the Rusting of Iron, which has been the subject of a valuable research by Dr. Moody, and an interesting article on the Reclamation of Land from the Nile—altogether a capital number.

"Proceedings of the American Society of Civil Engineers." Vol. XXXIII, No. 1, January, 1907. New York: The Society.

"Analyses of British Coals and Coke." Compiled by A. Greenwell and J. V. Elsden. London: The Chichester Press. 1907. Price 5s. net.

"Annalen der Elektrotechnik." 1907; part I. Leipzig: J. A. Barth.

"The American Institute of Architects Quarterly Bulletin." Vol. VII, No. 3, October, 1906. Washington, D.C.: The Secretary of the Institute.

"Technology Quarterly and Proceedings of the Society of Arts." Vol. XIX, No. 4, December, 1906. Boston, Mass.: The Massachusetts Institute of Technology.

"The Wire Tappers." By A. Stringer. London: T. Werner Laurie, Clifford's Inn. Price 6s.

"The Engineer's Year Book of Formulæ, Rules, Tables, Data, and Memoranda." By H. R. Kempe. London: Crosby Lockwood and Son. 1907. Price 8s.

Auction Sale.—Messrs. Fuller, Horsey, Sons and Cassell will sell by auction, on the 26th inst., at the Bravington Road Works, Harrow Road, W., the electrical plant, machinery, and stock of the Clift Manufacturing Co., Ltd., by order of the liquidator. For further particulars, see our advertisement pages to-day.

Admiralty Distribution Boxes.—We are informed that switches made by the Cantie Switch Manufacturing Co., of Mount Street, Nottingham, have been specified for these.

Advance in Prices.—The Armorduct Manufacturing Co., Ltd., announce that further substantial metal advances compel them to reduce the trade discount applicable to close joint conduit to 25 per cent. This alteration came into force on February 1st.

Catalogues and Lists.—Electric and Ordnance Accessories Co., Ltd., Aston, Birmingham.—Illustrated sheet No. L30, showing a complete range of self-contained portable electric drills (the "Midget," the "Slick" and the "Runtbru") and drilling pillars for use in connection with them. The cases are of cast aluminium, and the drills are as light as is compatible with high efficiency. By the addition of suitable fittings, these machines can be adapted for tapping, reamering and sawing, as well as drilling.

Messrs. Reid Bros, 12, Wharf Road, City Road, N.—32-p. illustrated pamphlet, giving full information concerning their pneumatic tubes, and views of important buildings which are equipped with them.

Messrs. Offord & Co., 97-98, Woodcock Street, Birmingham.—Small leaflet illustrating their apparatus for charging accumulator cells, also their cast-iron case switches (double pole).

The Union Electric Co., Ltd., Southwark, S.E.—List No. 5,005, giving brief details and prices of the necessary apparatus and supplies to be used in connection with Excello arc lamps (carbons, line resistances, automatic cut-outs, safety coils, transformers). Some general remarks are printed for enabling users to obtain the best conditions of burning for the lamps. A second new list (NE11) gives sizes and prices of Excello carbons for the above-named arc lamps.

Messrs. Z. Dessar & Sons, 5 and 6, Museum Street, W.C.—List of metal goods supplied. Scrap metals are bought, and spinning work is done on the premises.

Messrs. Mavor & Coulson, Ltd., Glasgow.—The firm's date card for February gives data relating to one year's working of a Pick-quick electric coal-cutter.

The Diamond Coal-Cutter Co., Stennard Works, Wakefield.—Postal card showing diagrammatically the result of certain recent coal-cutter trials in Scotland in a 20-in. seam, and holing in stiff fireclay, in which the "Diamond" two-motor disk cutter came out on top.

The General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—Booklet No. O 1,137, relating to motor-car accessories which are manufactured at the company's Peel Works, Manchester, and describing *inter alia* a new "Geeko" sparking plug, coil and charging board. Also booklet No. E 1,156, on Angold arc lamps, including new flame arcs and a "shuntless" arc lamp.

The Edison & Swan United Electric Light Co., Ltd., Queen Street, E.C.—Wall card, showing the "Royal Ediswan" Radio-Lite lamp (new pattern), with prices and particulars; calendar of notable events on the other side.

Messrs. Mountain & Gibson, Ltd., Elton Fold Works, Bury.—Handy pocket diary for 1907, arranged with one page per day. As this is serviceably bound, and contains much useful information, together with an insurance coupon, it should be much appreciated by recipients.

From the same firm we have received a pamphlet and folder containing pages illustrative of the work carried out by them; this includes maximum traction and radial trucks, complete single truck and bogie tramway cars, also electrically-driven watering cars, &c., as supplied to numerous corporations and companies.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester.—Circular No. 18, dealing with the "Lux" accumulator, a new cell specially designed for train lighting. The positives are of a special Planté type, of great strength, while the negatives are of the "box" type; wood separators are used.

Messrs. Kramos, Ltd., Locksbrook Engineering Works, Bath.—List No. 19 of mono-rail electric pulley blocks, transporters and small hoists, ranging from 3 cwt. to 5 tons, in over 50 standard sizes.

Messrs. A. Reyrolle & Co., Ltd., Hebburn.—Pamphlets No. 39, on quick-break iron-clad switch fuses (Berry patent) for 250 and 500 volts, 15 to 300 amperes; No. 42, H.T. tubular fuses, for 100 amperes at 3,000 volts or 50 amperes at 6,000 volts; No. 43, instrument fuses for 1 ampere at 2,200 volts, for use on switchboards.

The Linolite Co, 25, Victoria Street, S.W.—Leaflets giving prices and particulars of the various patterns of Linolite.

The New British Electric Supply Co., Ltd., 43, Stoke Newington Road, N.—Card drawing attention to their facilities for effecting quick repairs.

Messrs. W. Sisson & Co, Ltd., Gloucester.—A leaflet illustrating the adaptability of the "Sisson" patent single-crank engine to electric driving, including a full specification of the engine.

The Lahmeyer Electrical Co., Ltd., New Oxford Street, W.C.—A four-page leaflet dealing with the firm's variable-speed motors of the interpole type, and illustrating their application to machine-tool driving.

Messrs. J. Curwen & Sons, Ltd., 24, Berners Street, W., have forwarded us samples of Series II of Mr. Rockley's Electricity Picture Postcards. These are supplied for general correspondence purposes, or with printed instructions on the face for calling the attention of the electric supply department to (*a*) complaints, or (*b*) information required. Mr. Rockley's earlier efforts in this direction are well known to our readers; the present series will appeal to a certain class of consumer, and if suitably extended to meet general supply work, should prove of considerable utility.

Engineering Instruments, Ltd., 272B, Upper Street, Islington, N.—Price sheets Nos. 16, 17, 18 and 19, relating to automatic D.C. motor-starters, solenoid main and float switches; direct-acting three-phase automatic overload oil switches; three-phase change-over and combined star and mesh change-over oil switches; and enclosed three-phase oil type motor-control panels, respectively.

Messrs. Elliott Bros., Century Works, Lewisham.—Pamphlet A.C. 63, giving particular and prices of portable instruments, Model 22—ammeters, voltmeters and wattmeters—for A.C. or A.C. and D.C. combined. Also pamphlet A.C. 84, three-phase alternating-current wattmeters of various types, portable and switchboard, with a note on three-phase measurements.

The Consolidated Supply Co., Ltd., Northampton Works, Canonbury, N.—List No. 1 of quick-break knife switches with spring clip contacts, of various patterns, also tramcar fittings, &c.

Messrs. Bagshawe & Co., Ltd., 2 and 3, Tower Royal, Cannon Street, E.C.—Leaflet of mechanical conveyors, buckets, &c., and malleable-iron castings.

Messrs. Marples, Leach & Co., 6, Victoria Avenue, E.C.—Stock list of motors, with illustrations of some standard types; D.C. and A.C. motors are included. The list is enclosed in a convenient folding file for hanging on the wall, and the firm offer to send copies regularly to any reader who desires it.

The Electric Fittings Co, 38, Conduit Street, W.—A fully illustrated and priced catalogue of electric heating apparatus made by the firm. Many artistic designs of radiators and convectors, built on various systems, are shown, and the data given include energy consumption.

The Sterling Telephone and Electric Co., 200, Upper Thames Street, E.C., have forwarded us a mail card in celebration of the sixth anniversary of the Era automatic intercommunication telephone, of which an illustration appears.

Siemens Bros.' Dynamo Works, Ltd., York Street, S.W.—Price List 56 (superseding the January, 1906, issue), containing 56 pp. of illustrated and descriptive matter relating to direct and alternating-current instruments, instrument transformers, indicators, relays, &c. Recent additions to the list include small dial electro-magnetic and moving-coil instruments, combined volt-ammeters for motor-cars, and various novelties in indicators and relays. The list is arranged for filing in the firm's binder.

Kingstown Destructor.—Messrs. The Horsfall Destructor Co., of Leeds and London, have erected a destructor of their "back-feed" type at Kingstown, consisting of two cells, Babcock & Wilcox boiler, dust catcher, and Custodis chimney.

Electric Door Lock for Railway Trains.—Two Manchester gentlemen, Mr. A. McPetrie and Mr. F. A. Orchard, are reported to have patented, or to be about to patent, a process for the safety-locking of railway carriage doors by electricity. The process is described as exceedingly simple. It is automatic in action, and is operated from the dynamo used for electric lighting purposes. The principal part is let into the frame-work of the carriage, and when the train is in motion a bolt is shot into the

door to secure it. So soon as the carriage comes to a stand the current is automatically cut off and the bolt is withdrawn by a spring, thus releasing the door. Not the least important part of the invention, apart from its simplicity, is that a bell or other alarm can be sounded if a door is not properly secured.

Canada.—As evidence of the remarkable commercial growth of Canada, more particularly in the direction of electrical development, the Canadian General Electric Co., of Peterborough, has found it necessary to erect still another large machine shop, which means that between three and four acres will be occupied by this department. At present the machine shops at the works occupy 75,000 sq. ft. of floor area. The contracts for the new additions have been given, and the work is being proceeded with as quickly as possible. The increased facilities will necessitate a considerable increase in the number of employés.

Trade Announcements.—We are asked to make it clear that Mr. Walter Groves, of *The Motor*, and Mr. Ernest Groves, of the Sturmey Motors, Ltd., are in no way related to one another; no member of the staff or proprietary of *The Motor* has anything whatever to do with the company, of which Mr. H. Sturmey is chairman.

Mr. Arthur R. Walmsley has recently purchased the business of Messrs. Peacock, Cliffe & Co., Ltd., successors to Peacock & Co. (established 1884), engineers and founders, Manchester. The business will be carried on under the title of Messrs. A. R. Walmsley & Co. (successors to Peacock, Cliffe & Co., Ltd.), engineers and founders, Cornbrook Park Road, Manchester. Mr. Walmsley has had wide experience in engineering work, and has installed additional plant in foundry and machine shop.

Mr. Cecil A. Esmarch, who recently resigned his position as branch manager in Newcastle for Messrs. Bruce Peebles & Co., has opened offices at 17, Collingwood Street, Newcastle, and now represents the following firms for specialities in electric and general engineering:—Messrs. The Phœnix Dynamo Manufacturing Co., Bradford; Messrs. Higginbottom & Mannock, Ltd., Manchester; Messrs. Isaac Storey & Sons, Manchester; Messrs. Frank Wigglesworth & Co., Ltd., Bradford.

Mr. G. R. Peers, A.M.I.E.E., has ceased active connection with the firm of consulting electrical engineers, Messrs. Peers, Copland & Cardin, of 16, John Dalton Street, Manchester, and is now devoting himself to electro-medical work, giving the treatment on the introductions of medical men. He has equipped a large house at 344, Bury New Road, Manchester, with all the latest electrical appliances, including high frequency, continuous current, X-rays, light baths, electric water baths, &c., and is looking forward to being assisted by medical men in the same way that they assist others by sending their patients to similar institutions.

The Klein Engineering Co., Ltd.—From the 1st inst., the London address of this firm is 51, Moorgate Street, E.C. Telephone, 3,326 Central.

Bankruptcy Proceedings.—George M. Sellick, manufacturer of electrical accessories, 464, Romford Road, Forest Gate, E.—A receiving order was made on the 31st ult. at the High Court on a debtor's petition. The first meeting will be held on the 13th inst. at Bankruptcy Buildings, Carey Street, and on March 5th at the same address the public examination will be held.

Frank E. Williams (trading as F. E. Williams & Co.), electrical engineer, 328, Coventry Road, Birmingham.—The public examination will take place at the County Court, Birmingham, on March 18th. The first meeting is called for February 15th at 191, Corporation Street.

Cotton-Covered Wires.—In our issue of December 1st, 1905, we described a new process of wire covering, in which unspun cotton was used, instead of yarn, to form a felt-like covering on the wire. The owners of the patents—Messrs. Hutchins & Co., Ltd., of Crescent Works, Harlesden—inform us that they are enlarging their premises and putting down additional machinery for wire covering by this patent process. The Sloan Electrical Co., Ltd., of 15, Fore Street Avenue, E.C., are acting as selling agents for the covered wire, and will be glad to receive inquiries from the trade.

Dissolutions and Liquidations.—Messrs. Hill and Wood, electrical and general engineers and motor-car agents, 35, Chapel Street, Luton.—Messrs. H. Wood and J. Hill the younger have dissolved partnership.

Messrs. R. Foster & W. Baker (R. Foster & Co., and the Nelson Electrical Engineering Co., plumbers and electrical engineers, Nelson).—February 15th is the last day for sending in proofs for intended dividend to the trustee, Mr. C. H. Plant, 14, Chapel Street, Preston.

With reference to the notice appearing in our last issue regarding the dissolution of partnership between Mr. C. E. Foster and Messrs. Foster & Co., of Wimbledon, we omitted to point out that the date from which the dissolution took effect was February 19th, 1904.

Messrs. Norman & Gillitt, trading as electrical engineers and manufacturers' agents, 91, Pilgrim Street, Newcastle, have mutually agreed to dissolve partnership. Mr. Gillitt will carry on the business and defray all liabilities. Mr. Norman will continue to carry on the agency of Messrs. John Stevenson, Ltd., of Middlesbrough, for the British Mannesmann Weldless Steel Tube Co., Ltd., at Coronation Chambers, 70, Pilgrim Street, Newcastle-on-Tyne.

LIGHTING and POWER NOTES.

Accrington.—The Electricity Committee has recommended the T.C. to apply for a loan of £11,800 for the provision of two 500-kw. generating sets, a motor-generator, condensing plant and piping, water cooling tower, water cleaning plant, and cables, &c.

Acton.—A L.G.B. inquiry was conducted by Mr. H. R. Hooper last week into the Council's application to borrow an additional £20,000 for E.L. purposes. The £20,000 asked for included £1,538 overspent on the original sanction; buildings (extensions), £1,000; machinery, £2,097; mains and services, estimated to cover a period of two years, £14,300; tools, £250; instruments, £100; and general expenses, £514. Evidence was given by Mr. W. H. Trentham, consulting engineer to the U.D.C., and in respect to the £1,000 applied for under the heading of new buildings, it was stated that £700 of that represented expenditure intended on a sub-station. The Inspector said that would not be sanctioned, as the L.G.B. never sanctioned anticipated expenditure in regard to buildings. He also drew attention to the amount of £1,500 included in the loan for meters, and suggested that it would be much to the advantage of the Council to pay for them out of revenue. Local authorities were doing this almost everywhere. Mr. A. V. Palmer, secretary of the Acton Ratepayers' Association, asked that the Board's sanction be deferred until after the coming election, when the ratepayers hoped to return men pledged to greater economy and efficiency.

Bedwellty.—The U.D.C. has accepted the offer of the Rhymney Valley E.L. Co. for the supply of energy for public lighting at £2 17s. 6d. per 16-c.p. lamp per annum. Energy is also to be supplied to private consumers at the rates current in the company's other areas of supply.

Burnley.—The electrical engineer has submitted a report to the Electricity Committee regarding extensions to the boiler house, which include a new chimney, additional economisers, and the erection of another building, to meet the demand for next winter's load. The Committee, after considering the report, has instructed the engineer to submit alternative schemes at the next Committee meeting.

Canada.—The Export of Electric Power.—On 11th ult. the Dominion Government Bill to protect the interests of Canadian consumers of electrical energy, generated at Niagara Falls, and to ensure them an amply supply of power, was introduced by the Minister of Justice. In the course of the debate on the first reading, the Minister stated that the Bill involved no invasion of vested rights of an extraordinary character, and no greater interference with the management of private enterprises than is usually involved in cases where Government control is necessary to protect the public interest. With regard to the existing agreements made by the provincial authorities with two companies, restricting the export of electric power, the provisions of the Dominion Government's Bill would be a welcome aid to the enforcement of contracts as against the companies.

Ottawa.—A Government lease of the Beauharnois Canal has been granted to Messrs. Robert & McIntyre, of Montreal, for power development. Under the terms of the lease, the lessees assume the cost of maintenance at $20,000 a year, and must make an immediate expenditure of $60,000, and other outlays from time to time. They will have to pay the Government a rental of $12,000 a year, and to supply power to Montreal, Valleyfield and other municipalities at rates subject to the control of the Government. In this way the municipalities will get cheap power. Hitherto the canal has been a constant source of expense to the Dominion.

Fort William.—The electrical equipment of the large new mills recently erected for the Ogilvie Flour Mills Co. was supplied by the Allis-Chalmers-Bullock Co., Montreal, and comprises a main switchboard, an 800-h.p. induction motor, six smaller motors, lighting transformers, line switches, &c., which will be enlarged later on by the addition of another motor of 250 h.p. The most prominent feature is the large induction motor, the largest yet put up in Canada. It is direct-coupled to the main shaft of the mill, and power is taken from the shaft by means of belts and rope drives.

Pembroke.—Owing to the industrial growth of the town, the municipality has decided to increase its E.L. and power plant, and the Canadian Westinghouse Co. has just received an order for two 500-kw. and two 30-kw. generators, six oil-insulated 330-kw. transformers, and one four-panel switchboard for the control of the above.

Port Arthur.—The Grand Trunk Pacific Railway has made application for the right to develop power at the Dog Lake Falls, which it would use for various purpose in its shops and yards, and possibly on some of the short branch lines and sidings in the vicinity of Port Arthur. There are several applicants for the privilege, but so far nothing has been done in the matter.

Toronto.—Official notice has been given of the intention of the City Council to make application, at the next sessions of the Ontario Legislature, for an Act to authorise the city to expropriate the property of the Toronto Electric Light Co., Ltd.

The Western Ontario Municipalities Niagara Power Union, an organisation which has come into existence as a result of the power policy of the Ontario Government, will take action as soon as possible to secure the advantages of cheap power. Power by-laws have been passed by the various towns, and at a meeting recently held in Toronto, it was decided to ask the Town Councils of those municipalities which carried a power by-law, to notify the

Ontario Hydro-Electric Power Commission that they were in a position to make contracts with the commission for the supply of electric power, and were prepared to mention the amount of power required.

Montreal.—The application of electricity in the manufacture of bricks is exemplified at the works of the Laprairie Brick Co., near Montreal. The works consist of two plants, the older one steam driven, and the newer and larger one driven by electric power. For the electrically driven plant, energy is supplied from Chambly about 15 miles distant. The electric equipment, built by the Allis-Chalmers-Bullock Co., includes a 300-H.P. induction motor, operating grinders; three smaller induction motors of 30 H.P. each, driving fans for the drying kilns; two 15-H.P. induction motors, hauling shale from the field to the top of the grinders, and a 5-H.P. induction motor, driving a water pump. The electrical machinery has proved so successful that further additions have been decided upon, and the company has placed an order with the Allis-Chalmers Bullock Co. for further induction motors of 500 H.P., 30 H.P. and 15 H.P.

Halifax.—Construction work is to be commenced as soon as weather permits on the new electric railway from Halifax, through Rockingham and Bedford to Waverley. The line is owned by the Halifax and Suburban Electric Co., and the decision to push on the work at once, was the outcome of a recent meeting of shareholders. It is understood that American capitalists are assisting in the building of the line.

Niagara.—Our Toronto correspondent writes that on January 20th the Niagara River broke all records for high water, and the damage from flood was very great. The heaviest sufferer is the Gorge Electric Railway. The tracks have been undermined, and a long stretch of roadbed and tracks have disappeared into the river. The full extent of the damage will take some time to estimate, but it is certain that it will take a large sum of money to rebuild the line, and all traffic for some time to come will have to be handled *via* Niagara Falls Park and River Railway. There is also a heavy loss at the works of the Niagara Falls Hydraulic Power and Manufacturing Co., the Ontario Power Co. and the Canadian Niagara Power Co. This is principally caused by flooding, and the works of all the companies have been severely tested.

Carrick-on-Shannon.—On the morning of the 3rd inst. a fire broke out in the power station of the Killukin Mills, and resulted in the destruction of the station and plant, which consisted of two gas engines, four dynamos, accumulator, turbine, generator, &c. As the station supplied the lighting of the town, the latter is now practically without light; the water supply of the town was obtained by power from the same source.

Chelmsford.—The T.C. on January 30th discussed the Bill which is to be promoted, and which seeks power to transfer the electrical undertaking to the Electric Supply Corporation. The Council decided to ascertain exactly its own position in the matter, and what steps are to be taken by other local authorities affected by the Bill.

Cheltenham.—The Electricity Committee of the T.C. has recommended that a loan of £8,000 be applied for, for the provision of a 1,000-KW. set with condensing and auxiliary plant.

Continental Notes.—Italy.—A general meeting of the Hydro-electric Power Co., of the Upper Po, held recently at Turin, decided to increase the share capital from 1,200,000 lire to 2,000,000 lire.

The journal *L'Elettricita*, of January 18th, publishes an interesting article by Eng. Golwig on the innovations of recent years in the construction of large reservoirs for the Italian Electrical Generating Works; tables are given with the paper, showing the volume of water necessary under variable meteorological conditions for different sized stations, load factors and falls. Electrical tell-tale devices are used for indicating and recording the height of water in the reservoirs, and likewise the height of flow out of the reservoirs through the gates.

A recent Reuter telegram states that owing to the disorganisation of the railway service, a number of factories in Lombardy have been obliged to close, on account of the shortage of coal, and the Electric Supply Co., of Milan, will be unable to furnish power after the first few days in February.

Spain.—A large power station has lately been completed at Zamora where the water power of the River Duero is being utilised. The plant, which has been supplied by the Alioth Co., of Basle, Switzerland, comprises two 5,000-H.P. multiphase generators and five of 1,000-H.P. coupled up to vertical spindle turbines.

Norway.—The Kinserviks Co., Ltd., has acquired the water-power rights of the Ullen Valley, including four waterfalls formerly used by the Noske carbide factory, and equal to 50,000 to 55,000 H.P. It is reported that 600,000 kroner have been paid for the use of the falls for 75 years, after which they fall into the hands of the Government.

Russia.—The Russian Minister of Finance has presented a scheme to the Council of Ministers for placing a tax on electrical energy, gas and acetylene. The rate on the first named is fixed at 4 kopeks per KW.-hour, chargeable on 95 per cent. of the energy measured by the wattmeters to be employed. All attempts at fraud will be punishable by a maximum fine of 1,000 roubles or three months' imprisonment. If the Bill passes the Douma, it will come into force on January 1st, 1908, and will, it is estimated, have the effect of raising the price of energy 15 to 20 per cent.

Switzerland.—After negotiations extending over several years between Baden and the Swiss Government, a satisfactory conclusion has been arrived at in regard to the granting of a concession for the erection of a water-power installation near Augst Wyhlen, in the neighbourhood of Basle. It is assumed that, on the completion of the formal process of approval, it will be possible to begin the construction of the large works in the present year. The concession has been jointly applied for by the Rheinfelden Power Transmission Co. and the Canton of Basle, and the section of the Rhine covered by it extends a distance of 4·8 miles, with a fall of 28 ft. It is calculated that, at the lowest level of the water, the fall will yield 29,000 H.P. and 550,000 H.P. at the highest utilisable level, with an average of 100,000 H.P. for the year. The promoters propose to build a power station on each side of the Rhine.

Dalmatia.—It is announced from Genoa that the negotiations which have been proceeding for some time past between several Italian and foreign firms have led to the formation of a syndicate, which includes an Austrian banking institution in addition to Genoa capitalists, and owns a water-power concession on the River Aplmissa, in Dalmatia. The syndicate proposes to transfer the concession to a company, in which the Kerka company, in Dalmatia, the Società Italiana di Carburo di Calcio, of Rome, and the Società Generale per la Cianamide, of Rome, will be interested. The electrical works, which will be designed for the initial utilisation of a minimum of 25,000 H.P. and be capable of being increased gradually to 75,000 H.P., will be established in the neighbourhood of Spalato and the electrical power will be used in a large factory for the production of calcium cyanamide.

Croydon.—To "safeguard its interests," the Corporation has decided by petition, counsel and witnesses, to oppose the following Bills in the coming session:—The Administrative County of London and District Electric Power, the London Electric Supply, the London County Council (Electric Supply), and the London and District Electric Power.

Derby.—The E.L. Committee of the T.C. has decided to hire out flame arc lamps at £10 each per annum for alternating current, or £9 each for not less than four lamps, either alternating or direct current, including cost of maintenance.

Dudley.—The Corporation has decided to borrow the £10,641 necessary for the purposes of electric lighting and sanctioned by the L.G.B. in June last. It has also resolved to oppose the Smethwick E.L. Prov. Order, 1907, promoted by the Birmingham and Midland Tramways, Ltd., on the ground that it affects the interests of the borough.

Epsom.—The U.D.C. on January 30th, decided to apply to the L.G.B. for a loan of £3,600 for the extension of the electric light plant.

Failsworth.—The U.D.C. is seeking to obtain a supply of electricity from the Corporation of Manchester. The Manchester Electricity Committee, which has been waited upon by a Failsworth deputation, has inquired into the possibilities and does not find a sufficient guarantee to justify it in incurring the necessary expense for laying down mains. For that reason the matter has been deferred until there is a more pronounced demand, or till the supply can be more cheaply provided.

Foots Cray.—An agreement has been sealed whereby the Bexley U.D.C. undertakes to supply energy to the Foots Cray Electric Supply Co. at 3d. per unit for the first 20,000 units, 2d. for the next 80,000 units, and 1¾d. beyond, with a minimum payment of £250 per annum.

Halifax.—The electrical engineer has been instructed by the corporation to install five flame arc lamps by way of an experiment.

The Tramways Committee has offered to supply the Hipperholme U.D.C. with electricity in bulk at the undermentioned prices—namely, 3d. per unit for the first 20,000 units per annum; 2½d. per unit for all consumption above 20,000 units and up to 50 000 units per annum; 2d. per unit for all consumption over 50,000 units up to 100,000 units per annum and upwards. The Council to guarantee a minimum of not less than 20,000 units per annum at 3d. per unit. The Council to have the option of revising the above prices at the end of 21 years. The urban district includes Hipperholme and Lightcliffe, and is a rapidly thriving suburb adjacent to the municipal boundary.

Haslingden.—The T.C. has decided to oppose the application of the Lancashire Electric Power Co. for an E.L. order for Haslingden, Rawtenstall and Bacup.

Havant.—The U.D.C. has asked the Portsmouth T.C. if it is willing to extend the electric light mains to Havant, if the U.D.C. obtains a prov. order.

Heswall.—An electric light scheme has been submitted to the P.C. by a private firm, who offer, if the consent of the Wirral R.D.C. is obtained, to obtain a prov. order; the matter is to be considered at a special meeting.

Lancaster.—The T.C. has decided that in future the price to be charged the Tramways Committee for energy shall be 1·7d. per unit.

Leicester.—The Corporation has passed a resolution agreeing to oppose the Leicestershire and Warwickshire Electric Power Bill, which will come before the ensuing session. The power company seeks an extension of time to carry out its works. The Corporation appears to desire powers to supply energy outside its area, and on these grounds opposes the company's application.

Liverpool.—Eminently satisfactory is the condition of the Corporation electric supply undertaking; the accounts for the past year, which were published last week, showing a net balance of £53,484. Under these circumstances the Tramways and Electric Power and Lighting Committee has decided to transfer £18,771 to the reserve fund, £13,884 to the renewal fund, and £20,827 to the general rate.

The demand for electrical energy during the year steadily increased, the percentage over 1905 being approximately 7 per cent. for lighting, 21 per cent. for power, and 3 per cent. for traction.

London.—L.C.C. Power Bill.—The Hammersmith B.C. is to petition against the Bill, on the ground that the powers sought would, if granted, be prejudicial to the local electricity undertaking. Exception is especially taken to the proposal to compulsorily acquire the undertakings of the Borough Councils.

The Wimbledon T.C. is to petition against the Bill, as is also the Tottenham U.D.C.

The Bermondsey B.C. is to actively oppose the Bill. Attention is drawn by the Electricity Committee to the fact that power is sought to supply docks direct, and as regards Clause 10 Sub.-Secs. 3 and 4, an endeavour is to be made to delete the words "without the consent of such distributor, which consent shall not be unreasonably refused or withheld," the authority to the B. of T. to settle any such question, and the power to supply the docks direct. Efforts are also to be put forth to reduce the period in the clause dealing with the supply to authorised distributors, and which provides, *inter alia*, that an agreement must be entered into to take the supply for seven years. The Committee points out that the L.C.C., after taking over the undertakings of all the Borough Councils, except Marylebone and Woolwich, at the price of merely paying off the debts of same, could transfer them to a private company under the Bill as framed.

The Willesden U.D.C. is to petition against the Bill, in order to obtain protective clauses.

The Camberwell B.C., in compliance with the wishes of a deputation which has approached it from the Borough of Camberwell Progressive Association has agreed to oppose the Bill.

At a special meeting on the 5th inst., the Paddington B.C., by 46 votes to 3, decided, in order to save expense, to rescind a resolution directing that a petition be presented against the London and District Electric Power Bill, 1907, and to take no action in reference to the Bill. The Bill, said Mr. Chancellor P. V. Smith, in proposing the rescission, received no support during last session, and there was not much fear of it ever being passed.

The Southwark B.C. is to oppose the L.C.C. Supply Bill on the ground of the speculative nature of the undertaking, the certainty of an increase in the rates, and that no satisfactory provision is made for the protection of the electrical undertakings of the various borough councils, instituted and developed with the sanction of both Parliament and the County Council. In a long report drawn up by a joint committee upon the matter, it is pointed out that the provisions of the Bill would place a competing company, in an area like the parish of Newington served by a municipal undertaking, in an equal, if not better position than a local authority, inasmuch as in the event of the County Council being able to generate and supply energy in bulk at a cheaper rate than it could be generated by the local authority, the private company not having a generating station within the district would be empowered to demand from the County Council a supply of electricity which would enable it to undersell the energy supplied by the local authority. The local authority, unless the demand for supply far exceeded the output of its generating station, would thus be placed in the position of having to scrap its station and take a bulk supply from the County Council, or otherwise to continue its station and be undersold by the company. The committee further pointed out that if the Bill passed, the County Council might come into the district, lay down mains throughout the area, and seek out large consumers; and if the B.C. refused to permit the supply to be given by the L.C.C. instead of from the B.C. station, the County Council would be entitled, on showing to the B. of T. that it could supply energy at a cheaper rate, to effectively oust the B.C. from its position of supplying those consumers. Amongst the other objections advanced was that the County Council might, by using the powers of supply in bulk proposed to be conferred, seriously damage an undertaking and then refuse to purchase it, thus saddling the ratepayers of the district with the liabilities and debts of the undertaking, without a prospect of its making profits.

The Marylebone B.C. is petitioning against the Bill, to enable the B.C. to obtain protective clauses, and to oppose other clauses. The Electric Supply Committee in a report upon the matter, objects to the provisions of the measure for a supply to individual consumers, and goes on to say that the practical effect of the provisions appears to be that the County Council is to be allowed to enter into direct competition with authorised distributors in the supply of energy for power, or, to a limited extent, for lighting, if it is able to show that it can supply energy cheaper than the authorised distributors. If the Bill is passed in its present form, the result would be that in Marylebone and in any other boroughs where the County Council did not choose to acquire the undertakings, there would be a reasonable likelihood of two bodies, viz., the L.C.C. and the B.C., both entitled to draw upon the rates, and to some extent upon the rates of the same area, competing with one another in the supply of electricity. Objection to the Bill is further based upon the fact that the B.C. would be liable for the losses which the County Council will probably suffer, and strenuous efforts are to be made for the insertion of a clause providing that a special electrical rate should be levied in the event of losses arising from the proposed scheme, and that Marylebone and any other boroughs whose undertakings are not taken over should be excluded from such rate.

The Lambeth B.C. is to petition against the Bill in order to obtain a *locus*. Whether counsel are to be instructed has not yet been decided.

Bermondsey.—To meet the increasing demand for energy the Electricity Committee reports that it will be necessary to extend the mains in 16 streets, at an estimated cost of £8,357. Application is to be made to the L.C.C. for sanction to borrow this amount.

Paddington.—The General Purposes Committee has reported being in communication with the Metropolitan Electric Supply Co. in regard to the proposed removal of their generating station and a reduction in the price charged for energy. The Committee states that it hopes soon to be in a position to fully report upon the matter.

Southwark.—The B.C. has decided to oppose the various electricity supply Bills promoted by private companies.

A return is to be prepared for the information of the Councillors, showing (*a*) total loans on electric light, (*b*) amount paid off, (*c*) amount outstanding, with interest thereon, (*d*) engineer's estimates of present value of machinery, (*e*) of annual depreciation, (*f*) of probable life of the electric light plant, (*g*) cost of generation per unit for street lighting, (*h*) private lighting, and (*i*) power, (*j*) price charged per unit for street lighting, (*k*) private lighting, and (*l*) power.

Westminster.—The Guardians, being dissatisfied with the price of gas, are asking for quotations for the electric lighting of the workhouse buildings.

Maryport.—An E.L. installation is being laid down at the Solway Ironworks by Messrs. Cammell, Laird & Co. Hitherto gas has been used at the works.

Newark.—Another move towards an electricity supply for the town has been made. The Committee recommended that Mr. Mountain, electrical engineer of Huddersfield, be requested to make a general report on the supply of electricity in the borough, and on a scheme for a supply by the Corporation, the Committee having had an interview with him, his fee to be 25 guineas. Alderman Knight (chairman) said that since the last meeting a letter had been received from the Mutual Electricity Supply Co., asking for an interview, and one had been arranged. There had been other communications from different companies, but they had all withdrawn, excepting the Mutual Co. and a local syndicate. The recommendations of the Committee were agreed to by the T.C., and a report by Mr. Mountain is now awaited.

Otley.—The E.L. prov. order, which was obtained six years ago, and extended twelve months ago for one year, has now lapsed. The B. of T. refused a further renewal of the order, and informed the U.D.C. that it had no power to dispose of the order to a company as the Council proposed.

Reigate.—The T.C. has instructed the electrical engineer to report upon the advisability of increasing the plant at the generating station.

Stourbridge.—The B. of T. has formally approved of the transfer of the E.L. order to a private company.

United States.—Niagara Falls.—A lengthy report has been issued by Mr. Taft, the U.S. Secretary of State for War, on the question of the development of the water power at Niagara and on the transmission of Niagara power from the Canadian side to the State of New York. The three power companies doing business on the Canadian side at Niagara are to be permitted to transmit 160,000 H.P. into New York, Mr. Taft having rendered a decision to this effect on January 18th last. The Canadian Niagara Power Co. asked permission to transmit 121,000 H.P. across the border. The Ontario Power Co. asked to be allowed to transmit 90,000 H.P., and the Electrical Development Co., a permit for 62,500 H.P., while the International Railway Co. wanted 8,000 H.P.

Mr. Taft's report goes into the question of applications to divert water for power purposes on the New York side. The Niagara Falls Power Co. is utilising 8,600 cb. ft. of water per second and developing 76,630 H.P.; the Niagara Falls Hydraulic Power and Manufacturing Co. is using 4,000 cb. ft. per second, and has under construction, for a period long ante-dating the Burton Act, a plant arranged to divert 2,500 cb. ft. per second, and to furnish 36,000 H.P. to the Pittsburgh Reduction Co. Permits to utilise these quantities of water will accordingly be issued, but it is stated that water for sluicing must be obtained from the quantity allowed—"water for other purposes when sluicing is being done must be diminished." As water is being drawn from the Erie Canal for power purposes, Mr. Taft approves of a permit being granted for 400 cb. ft. per sec. to the first user.

The report continues, this leaves 158,500 H.P. to be distributed between the other three applicants, and after careful review of all circumstances, he has issued permits for transmitting energy into New York as follows:—The Ontario Power Co., 60,000 H.P.; the Canadian Niagara Power Co., 52,500 H.P.; and the Electrical Development Co., 46,000 H.P. The distributing agent for the Ontario Power Co. on the New York side is the Niagara, Lockport and Ontario Power Co. The transmission lines of this company have already been erected to Rochester and Syracuse and West Seneca. The Niagara Falls Power Co., of N.Y., and the Cataract Power and Conduit Co., of Buffalo, will distribute the energy for the Canadian Niagara Power Co., while the Niagara Falls Electrical Transmission will distribute for the Electrical Development Co. in Western New York.

In conclusion, the report states that the chief engineers and Capt. Kutz will prepare permits after consultation with counsel for the respective companies; Capt. Kutz is also recommended to report a plan for the supervision of the operation of these companies under the permits, with a view to securing strict compliance with their terms. It may be mentioned that Mr. Taft intimates that any evidence of combination between the three companies, if brought him, will be given careful consideration as a modification of his action in granting the permits.

In regard to the preservation of the Falls, their scenic grandeur, &c., Mr. Taft has given some consideration to this matter. He gave hearings to the American Civic Association and to others interested in this question, and states that with the diversion of 15,000 cb. ft. on the New York side, and the transmission of 160,000 H.P. from the Canadian side, the effect will not be perceptible to the eye. He, however, refers to the condition of the U.S. bank of the gorge as an "eye-sore," and in order to determine what ought to be done to remove it, he has appointed a committee to advise him what changes, at an expense not out of proportion to the extent of the investment, can be made which will put that side of the canyon in natural harmony with the Falls and other surroundings, and will conceal as far as possible the "raw commercial aspect that now offends the eye."

Regarding the decision of the U.S. Government to fix the power to be transmitted across the Falls from Canada at 160,000 H.P., as the various power companies in Ontario are authorised to develop 415,000 H.P., it means that 255,000 H.P. will be available for use on the Canadian side. Under the provisions of the companies' various charters, it appears that they have power to export half of the H.P. they are permitted to develop, but according to Mr. Taft's decision they cannot export as much power as formerly under the Ontario statute.

The decision should have the effect of stimulating the building of transmission wires and plants in Ontario, since the companies have to procure a market somewhere, and now it can hardly be in the States. The charters of the three companies provide for the development of horse-power as follows:—Ontario Power Co., 180,000 H.P.; Canadian Niagara Co., 110,000 H.P.; and Electrical Development Co., 125,000 H.P.

It is understood, however, that a treaty is to be negotiated between Canada and the United States, and it is believed that this treaty will fix the amount of water which may be taken from the Niagara River, limiting it to the requirements of existing franchises. When this treaty is passed, the Burton Bill will probably become ineffective, and all the companies will be placed on an equal footing, subject, of course, to the provisions of the Export Bill now pending before the Dominion Government.

Warwick.—The C.C. has entered into an arrangement with the Leamington and Warwick Electrical Co. for the supply of energy for lighting the County Hall at Warwick, at 7d. and 2d., the total charge not to exceed an average of 5d. per unit.

Wednesbury.—The Lighting Committee of the Corporation has decided that electricity for lighting purposes be supplied to all business premises at a flat rate of 3d. per unit, on condition that an agreement be entered into with the Corporation by every person requiring to be supplied at that rate agreeing to take electricity without interruption from dusk to the hour of 11 p.m.

A difference having arisen with the British Accumulator Co., Ltd., respecting the battery of accumulators supplied to the Corporation's electricity sub-station, it has been decided that the necessary steps be taken for the settlement of the difference by arbitration, in accordance with the terms entered into with the company.

Willington.—A petition is being promoted asking the U.D.C. to rescind its recent decision refusing the offer of the County of Durham Electrical Power Distribution Co. to supply energy to the district at a flat rate of 3¾d. per unit, less 5 per cent., if overhead mains were used. The Council refused the offer, because of its objection to overhead construction.

TRAMWAY and RAILWAY NOTES.

Accrington.—The Accrington Corporation Steam Tramways Co., in their annual report, record a profit on the year's working of £6,521, and declare an all-round dividend of 6 per cent. The company's lease expires in April, and the undertaking is to be taken over by the Accrington Corporation and electrified.

Bedford.—The T.C. has decided to take no further steps towards obtaining an extension of time for the construction of tramways in the borough, as authorised by the Order obtained in 1900. It has also been decided to inform Messrs. Baker & Co. that the Council is not prepared to give its consent.

Birkenhead.—A Northern correspondent says that it is stated that the powers which the Great Western Railway Co. seeks to obtain in its new Bill, to enable it to electrify certain portions of its system, refer to the Birkenhead and Chester line. This line, about 15 miles long, is worked jointly by the G.W. and L. & N.W. Companies. The line serves a rapidly growing residential district, and if worked by electricity, trains could be run direct into Liverpool through the Mersey Tunnel, instead of passengers having to change at Rock Ferry Station.

Blackburn.—The profit on the Blackburn Corporation tramways for the past nine months was £1,726. The system has never yet paid on the full 12 months' working, but there is a prospect of this being attained, says the borough treasurer, if the weather favours traffic during the current quarter.

Bradford.—A car, in negotiating a curve on an incline in Wakefield Road, collided with a wagon, which is reported to have damaged the car controller, and rendered the brakes inoperative. The car descended the incline and jumped the track, smashed a lamp standard, and was finally brought up by a tramway pole. One passenger, who jumped from the car, was injured, but those who remained on board only complained of shock.

Burnley.—The R.D.C. has been informed by the town clerk of Rawtenstall that the Corporation has withdrawn that portion of its Parliamentary Bill which related to the proposed tramway to Burnley.

Canada.—TORONTO.—Plans for the extension of the Niagara, St. Catherine's and Toronto Railway have been filed with the Government authorities. The proposed extension will pass through the municipalities of Fort Erie, Bridgeburg, Willoughby and Stamford, and the object of it is to provide continuous transportation over the company's lines exclusively from Toronto to Buffalo.

A dispute, which has reached an acute stage, is now pending between the Toronto Street Railway and the municipality. The main question at issue is whether the company has a right to alter, without the consent of the city authorities, the routes that have been arranged by agreement under the street railway contract. Recently the company, without consulting the city, and in direct opposition to the recommendations of the city engineer, made considerable alterations in various routes traversed. As no notice was taken of the protests made, the Council invoked police aid, and refused to allow cars to proceed except by routes approved by it. In consequence, the company withdrew all its cars from the routes in dispute, and refused to run them, except over the routes which it favoured. Consequently at the present time there is a deadlock, and much inconvenience is being experienced by people living in distant suburbs. An emergency meeting of the City Council has been held, at which it was resolved unanimously to apply to the Ontario Railway and Municipal Board forthwith to compel the Toronto Railway Co. to operate the routes discontinued on the 22nd inst. pending the enforcement of the agreement between the city and the Toronto Co.

HAMILTON.—Notice is given that application will be made to the Canadian Parliament during its present session for an Act to amend the charter of the Hamilton Radial Electric Railway Co. by providing for considerable extensions to its system, and to authorise it to purchase, lease or amalgamate with other Hamilton electric railways, to build and operate ferry steamers, and to construct an international bridge over Niagara River.

Colwyn Bay.—On the 31st ult. the Light Railway Commissioners were occupied at Colwyn Bay in hearing evidence for and against the application of the Llandudno and Colwyn Bay Tramways Construction Co. for powers to run a light railway through the town. The application was supported by the U.D.C., and, we gather, was successful.

Continental Notes.—ITALY.—The commission charged with the examination of the law as to working railways, &c., has reported in favour of rescinding the clause in the existing law which prohibits working tramways or automobiles on any route which may compete with the State railways.

The plans and sections for the Chioggia-Padua Electric Railway are now being prepared. There will be six intermediate stations, a swing bridge, and a permanent bridge. The estimate amounts to 8,000,000 lire, part of which will be borne by the State and the balance divided between the provinces of Venice and Padua.

A company has been formed to work an electric tramway line between Salerno and the valley of Pompeii. The shares have been fixed at 200 lire (£8) each, 20,000 of which will be issued to the public.

PARIS METROPOLITAN RAILWAY.—The Compagnie du Chemin de Fer Métropolitain of Paris has just published the working results of the traffic on the five lines in operation in 1906. These have a total length of slightly over 32 miles, of which seven miles were at work only during part of the year and 2¾ miles only during the last two weeks of the year. The number of tickets issued was 165,319,216 as compared with 148,700,821 in 1905, and the total receipts amounted to 28,753,347 fr. The share of the city in the revenue totalled 9,353,553 fr. as contrasted with 8,388,106 fr. in 1905, being an increase of 965,447 fr.

GERMANY.—The department of the Prussian Ministry of Public Works has for a long time past been engaged with other authorities in giving consideration to the question of the establishment of electric traction on one of the Prussian railways. As reported by a semi-official newspaper, the investigation has now led to a favourable decision in regard to the main line between Altona and Kiel, a scheme for the conversion of which was prepared some time ago by the Berlin Allgemeine and the Siemens & Halske companies. The length of the railway is 62 miles, and it is said that the question of extending the proposed system to other railways will depend upon the results attending the working of the Altona-Kiel section. This section is to be electrically equipped, both for passenger and goods trains, as it is desired to ascertain how, in the present condition of electrical engineering, the whole of the traffic on a busy line can be handled without the use of steam locomotives. The preparations for the execution of the work have already been

commenced, and it is expected that electrical working on the railway in question will be inaugurated this year. It is declared not to be accidental that a section has been selected for the trials that is of prominent strategic importance for Germany, and that commercial, industrial and military circles are equally interested in the scheme for electric trains on the State railways. The accuracy of the foregoing statement is, however, contradicted by a second newspaper, which is also credited with official inspiration. The latter states that the project is still in a preliminary stage, and that estimates are first of all being prepared with a view to comparing the cost of introducing electric traction with that of steam locomotion.

Dublin.—As the centre poles of the D.U.T. Co. on the route from the city to the International Exhibition in Herbert Park might interfere with the traffic when the Exhibition was opened in May, a Dublin correspondent says that it is proposed to have them removed, and that the work is to be commenced at once. The Pembroke U.D.C. has given permission for the company to lay down a third track along that portion of the thoroughfare leading to the front entrance of the Exhibition grounds. All expense is to be borne by the company, which may include the alteration of pathways, &c. A great deal of attention is being devoted to transit facilities during the period the Exhibition may remain open; a proposal has been put forward to import a number of 'buses to run in competition with the tramways.

Eccles.—The Corporation has instructed the electrical engineer to prepare plans and specifications of the electrical equipment and plant required for the supply of energy from the electricity works at Patricroft, for the working of the tramways within the borough.

Lancaster.—Six months ago, against the advice of the electrical engineer and tramways manager (Mr. Tester), the Council decided to withdraw ½d. fares from certain stages. At a recent meeting of the Town Council it was reported that there had been 94,000 fewer passengers since the ½d. fares were abolished, and there were 31,000 fewer during the past six weeks. It was decided to reinstate the ½d. stages. Discount tickets, which were also abolished some time ago, have been again adopted—26 for 1s. on the ½d. stages and 13 for 1s. on the 1d. ones.

Leyton.—The U.D.C. has received from the B. of. T. sanction to a loan of £14,500 for the purchase of 20 tramcars, and to one of £20,406 for the purchase of the undertaking at Leyton of the North Metropolitan Tramway Co.

Liverpool.—From an extract from the Corporation accounts, presented at the meeting of the Council recently, we gather that the Corporation electric tramways are making further progress. The income for the year 1906 was £583,620, being an increase over the previous year of £16,991. The approximate expenditure in 1906 was £53,224 interest, £56,337 sinking fund and repayment of loans, and £391,300 working expenses. With regard to the estimated expenditure on capital account for the current year, the sum is set down at £25,000 two interesting items being £12,000 for additional cars, and £2,000 for motor vehicles, sanction for which has yet to be obtained.

The Tramways Committee of the Corporation recommends that an application be made to the Board of Trade for a provisional order authorising the construction of a line of tramways from the Black Bull, *viâ* Walton Vale, and Derby Road to Strand Road.

London.—L.C.C.—At the meeting of the County Council on Tuesday, various questions were put to the chairman of the Highways Committee in regard to the tramways. In reply, Captain Hemphill stated that the proposal for the construction of the Aldwych-Southampton Row subway was before the Council in 1901, and a cartoon was exhibited in the Council Chamber showing accommodation for single-deck cars. The question of using double-deck cars was discussed, but after full consideration the Council resolved to construct the subway as it was. The cost of the subway was £282,000, and that sum would be increased by from 40 to 50 per cent. if it were made suitable for double-deck cars. A repeated request made to the chairman for the name of the expert who advised the adoption of a tunnel of the size adapted for the use of the present cars failed to elicit a reply.

A collision occurred on Tuesday last at the junction of Borough Road and Southwark Bridge Road between two of the L.C.C. cars. It appears that the points were not operated correctly, and we gather that the cars came together with great violence. Those on the cars suffered from shock, and a conductor sustained cuts from broken glass. Traffic was suspended on this section for a considerable period.

Estimates have been approved for the reconstruction for electric traction of the tramways in Goswell Road and Aldersgate Street, Pentonville Road and Gray's Inn Road, at a cost of £115,860, and for an additional supply of rails to cost £81,000.

A number of halfpenny stages have been approved for the northern section.

Through cars are now being run from the Embankment to the Tower Bridge, Lewisham, Catford, Blackwall Tunnel, Streatham, Tooting, Greenwich and Clapham Junction.

A Press report states that it is proposed to widen Putney Bridge, across which it is intended to bring the L.C.C. tramway that is destined to link up the Middlesex C.C. tramway at Harlesden with Shepherd's Bush, Hammersmith, and the south of London. The contract for the work is about to be given out.

Islington.—The B.C. has received a letter from the L.C.C. requesting the former to rescind its resolution requiring the adoption of the conduit system for the electrification of the tramways throughout the borough, and to consent to the use of the overhead trolley method of traction along certain routes. The County Council points out that these routes are well suited for the trolley method, the completion of which would occupy only half the time needed for the conduit system, and would also result in a saving of £40,000. Moreover, trolley traction is already operative outside the London county boundary at Finsbury Park, and its use on the routes under consideration would enable a very important interchange of traffic to be effected, which would be of advantage to all the districts affected. The matter has been referred to the Works Committee of the Islington B.C.

Camberwell.—The B.C. has agreed to inform the L.C.C. that it is not prepared to consent to the overhead system of traction in connection with the Dulwich tramway extension from Barry Road to Forest Hill.

Mexborough.—We understand that the B. of T. inspected the Dolter tramway system between the Rotherham borough boundary and Rawmarsh last week, and that permission has been granted for the running of the cars.

Rawtenstall.—The electrification of the tramways in the district of Rawtenstall and Bacup, at a cost of £223,000, has been sanctioned by the ratepayers. A Bill in Parliament is being promoted by the local authorities

The poll of the ratepayers taken on the question of the proposed extension of the tramways from Waterfoot to Water, at a cost of from £30,000 to £50,000, has resulted in a majority of 454 votes against the extension.

South Lancashire.—We learn that the South Lancashire Tramways Co. has arranged terms with the Salford Corporation with respect to running cars through Winton on the Corporation's line to Peel Green, from Worsley, where the company's lines diverge to Swinton in one direction, and Tyldesley and Atherton in the other. The line to Winton and Peel Green was completed several months ago.

Sunderland.—At a meeting of the Tramways Committee on the 31st ult., a statement was presented showing the result of the year's working. The Committee anticipates being able to hand over to the borough fund from the net profits a sum of £6,000 at the end of the year's working. This compares favourably with last year, when the amount given for the relief of the rates was £3,541. The financial year does not close until the end of March next.

Tipton.—The Wednesbury Corporation has approved plans for the reconstruction and re-equipment for electric traction of the section of the steam tramways between the Dartmouth Arms and the Tipton boundary; and, subject to certain requirements of the borough surveyor being complied with, it has also given consent to the lowering of the roadway under the Great Western Railway at Leabrook, to enable double-deck tramcars to pass under it.

York.—In their report to be presented at the half-yearly meeting on February 13th, the York Tramways Co. state that they have entered into an agreement with the York Corporation, subject to confirmation by the shareholders and the Council, for the sale of the undertaking for the sum of £11,000. The purchase money is to be paid in July, 1909, or within three months after the Corporation shall have obtained power to work the tramways, or to construct and work the same as a light railway, as the case may be, whichever shall happen first.

TELEGRAPH and TELEPHONE NOTES.

Aberdeen.—Owing to a fire which broke out in the central offices of the National Telephone Co., Ltd., on Friday last, the telephone service of the city was practically suspended, 1,200 lines being cut; the damage done, however, was not very serious.

Canada.—The telephone exchange operators of the Bell Telephone Co., at Toronto, struck work on the 31st ult., to resist an increase in the working hours. They urge that 5 hours' work is the maximum that they can endure.

French Cables.—The French Administration notifies that the Madagascar-Réunion cable lands at Tamatave, Madagascar, and at St. Denis, Réunion, and is 430·950 nautical miles in length. The Réunion-Mauritius cable also lands at St. Denis and at Port Louis, on the latter island, and is 131·295 nautical miles in length. —*Journal Télégraphique.*

Glasgow.—The Post Office is offering the telephone operators 8s. per week, rising to 14s. in three years, and the operators demand to be put on the same footing as other telephone operators employed by the Post Office, who receive a higher maximum and a pension.

Italy.—An important telephone line, as regards the safety of travellers, has now been opened between the Hospice on the small St. Bernard Pass and Lansbraulette.

Panama.—H.M. Consul at Panama reports that the shareholders of the Central and South American Telegraph Co. have resolved to lay a direct cable between New York and Panama.

The new cable will have a length of 2,200 miles, representing a saving of 2,000 miles over the *vid* Galveston route belonging to the same company, and there will be only one intermediate station, namely, at Baracoa in Cuba. The company also propose to introduce into their service a telegraph line along the routes of the railway companies of East Oran, Argentina, and Buenos Ayres, on the Pacific side, besides the establishment of a new land telegraph between Buenos Ayres and Valparaiso. All these contemplated improvements are to be put into operation in 1907.—*Board of Trade Journal.*

Poulsen Wireless Telegraphy.—We understand that at Cullercoats, near North Shields, where the Amalgamated Radio-Telegraph Co. have a wireless station, experiments with the Poulsen system (described in our issue of November 16th, 1906) are being carried out this week between the above station and two Poulsen stations at Esbjerg and Lyngby in Denmark. Mr. Babington Smith, secretary to the Post Office, and Mr. J. Gavey, engineer-in-chief, the Post Office delegates to the International Radio-Telegraph Convention at Berlin, are present, as well as Admiral Jackson and Lieut. Loring, of the Navy, and Mr. S. S. Bojesen, managing director of the Amalgamated Radio-Telegraph Co. The experiments are important, and the results should be of great interest.

It is rumoured that an action is on foot before the German Patent Department with the object of annulling the patents granted to Herr V. Poulsen in connection with his system of producing undamped vibrations of high frequency for wireless telegraphy and telephony.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 1.)	Aug. 26, 1901	..
Paramaribo-Cayenne	Nov. 27, 1906	..
Cayenne-Pinheiro	Aug. 13, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Dominica-Martinique	May 7, 1902	..
Mole St. Nicholas-Port au Prince	Aug. 16, 1906	Feb. 3
Curacao-Coro	Closed	..
Curacao-La Guayra	Closed	..
Curacao-Maracaibo	Closed	..
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904	..
Garachico-Santa Cruz	July 12, 1906	..
Las Palmas-Arecife	Aug. 18, 1906	..
Guantanamo-Mole St. Nicholas	Nov. 22, 1906	..
Mole St. Nicholas-Cap Haytien	Nov. 22, 1906	..
Fao-Bushire	Dec. 4, 1906	..
Martinique-Paramaribo	Dec. 17, 1906	..
New Brunswick-Prince Edward Island	Jan. 9, 1907	..
Landlines.		
Puerto-Barrios	Aug. 28, 1902	..

Wireless Telegraphy.—It is stated that all the vessels of the Canadian Pacific Railway are to be in future equipped with wireless telegraphic apparatus. The Royal Mail steamers on the Atlantic service have already been so furnished, but it is now the intention of the company to put the apparatus not only in the Pacific expresses but also in all their coasting steamers.

An appeal has been made to the Dominion Government, asking that arrangements may be made for the wireless transmission of messages between Prince Edward Island and the mainland until the broken Anglo-American cable is restored. Owing to the ice in the Strait this cannot be done until the spring.

CONTRACTORS' COLUMN.

Openings for New Business.

BELFAST.	Large spinning mill in contemplation by a local syndicate.
BEXHILL.	New opera house and winter garden.
BIRKDALE.	Rebuilding St. Peter's Church. F. P. Halsall, architect, Corporation Street, Southport.
BOWNESS (Windermere).	Motor-car works and garage. John Stalker, architect, Kendal.
BLACKROD (Lancs.).	Woods & Sons are restarting their bone colliery.
BRISTOL.	Rebuilding of "The Rising Sun." W. Cowlin & Son, Stratton Street, Bristol, builders.
BRISTOL (near Cumberland Basin).	Tobacco warehouse for Corporation requiring electric lifts, lighting, &c. W. W. Squire, dock engineer, Cumberland Road, Bristol. W. Cowlin & Son, Stratton Street, builders.
BURNLEY.	New school at Fulledge. Mr. Pickles, architect.
BURNLEY.	New Technical School. Mr. Pickles, borough surveyor and architect.
CHISWICK.	New Wesleyan Church in Sutton Court Road (£6,000).
CROSSGATES (near Leeds).	Extension of Wesleyan Church and erection of lecture hall and class rooms. Danby & Simpson, architects, 73, Albion Street, Leeds.
DERBY.	Ley's Malleable Castings Co. may erect new works here.
DUNDEE.	New technical institute (£25,000), with special department for electrical engineering. Robert Gibson, architect, Dundee.
EASTBOURNE.	Rebuilding, Pevensey Road Wesleyan church and schools.
ECCLES.	Council school.
EDINBURGH.	New municipal art school.
ENFIELD.	School at Bush Hill Park. Builders, W. Lawrence and Sons.
FARNWORTH.	New town hall (£10,000). J. H. Lomax, surveyor, Council Offices.
FARNWORTH.	Sewage works (£22,000). J. H. Lomax, surveyor, Council offices.
GALASHIELS.	New technical college for the South of Scotland College at Galashiels.
GLASGOW.	Royal infirmary (£500,000). E. Barclay, secretary, Buchanan Street, Glasgow.
GLASGOW.	Library. A. B. Macdonald, city engineer.
GREENOCK.	Prison. H.M. Board of Works, Edinburgh.
GUILDFORD.	New technical institute (£10,000).
HACKNEY.	The public library, mentioned last week, is to be located in Mare Street, and the builders are Edwards and Medway.
HALIFAX.	Shops and offices, St. George's Square. Architect, T. Kershaw, L. and Y. Bank Chambers, Halifax.
HEYWOOD.	New school (600) for Heywood Education Committee.
HULL.	New woollen mills.
INDIA OFFICE.	Additions to Supply Stores at Lambeth (£60,000).
KILBURN.	New music-hall in Kilburn High Road.
KILMARNOCK.	New Post Office buildings. W. T. Oldrieve, architect to H.M. Office of Works in Scotland.
LANCASTER.	New Town Hall. E. W. Mountford, architect, London. Waring White Building Syndicate.
LANCASTER.	New School in Dallas Road. J. C. Mount, borough engineer.
LANCASTER.	Technical schools, extension of Storey Institute. Austin & Pailey, architects, Lancaster. R. Thompson, builder, Dalton Square, Lancaster.
LITTLE HULTON (near Bolton).	New works for Union Foundry Co. Builder, James Cocker, Walkden, Manchester.
LONDON, E.C.	Block of buildings in Fleet Street (107-109) for Cook's (tourist agents). Builders, Patman & Fotheringham.
LONDON, (Harrow Road).	New Hippodrome (to seat 2,000 odd).
LONDON (Paul St., Finsbury).	Factory extensions for Waterlow & Sons, Ltd., 26/27, Great Winchester Street, E.C.
LONDON (Hammersmith).	Imperial Tobacco Co., 81, Fulham Palace Road, S.W. New buildings.
LONDON (Shepherd's Bush).	Dancing academy. W. F. Hurndall, 84, Blackfriars Road, S.E.
LONDON (Marylebone)	Shops and concert hall. Joseph & Smithem, architects, 83, Queen Street, E.C.
LONDON (Mayfair).	Garage and office buildings. Pilditch & Co., architects, 2, Pall Mall East.
LONDONDERRY.	School of Domestic Economy. M. A. Robinson, Richmond Street, Londonderry, architect.
OLDHAM.	Council school. Edward Stephenson, builder, Union Street, West Oldham.
MANCHESTER.	New Sorting Office. Mr. Atlee, H.M. Office of Works, New Bridge Street, Manchester.
NEWARK.	New elementary school (£9,000). Mallows & Grocock, architects, Bedford.
NEWARK.	Workhouse infirmary alterations and additions. Mr. Marshall, architect, Nottingham. J. G. Short, builder, Nottingham.
NEWARK.	New post office. Saunders & Saunders, architects, Newark.
NEWCASTLE.	Primitive Methodist school. Architects, Howdill and Howdill, 7, Oxford Row, Leeds.
NORBURY (Croydon).	Church. Warwick Road. Architect, W. S. Weatherley, 2, Haymarket, S.W.
NORTHUMBERLAND.	Ten new secondary schools (£46,000) for the Education Committee.
NORWICH.	Roman Catholic cathedral. J. O. Scott, architect, Dean's Yard, Westminster, S.W.
NORWICH.	Head office for Norwich & London Accident Insurance Association. G. & J. Skipper, architects, London Street, Norwich.
NORWICH.	London & Provincial Bank new buildings. G. & J. Skipper, architects, London Street, Norwich.
PLYMOUTH.	New public library, museum and art gallery, to the designs of Thornely & Rooke.
PONTEFRACT.	All Saints' Schools. Also operating theatre and anæsthetic room at Pontefract Infirmary. Garside and Pennington, architects, Pontefract.
RADCLIFFE (Lancs.).	Restarting collieries at Coney Green. Mr. Campbell, mining surveyor, Summit House, Heywood, Lancs.
ROCHESTER.	New City Technical Institute. George Gates & Son, Frindsbury, builders.
ROTHERHITHE.	Extensions to infirmary, Lower Road, for Bermondsey Guardians (£42,000).
SHEFFIELD.	Additions, &c., to Fulwood Council School. C. J. Innocent & Son, architects, 22, High Street, Sheffield.
SOUTHPORT.	New works for Vulcan Motor Co. at Crossens. W. Townson & Sons, builders, Bolton.
TOLWORTH (near Surbiton).	Extensions and alterations to Isolation Hospital. W. H. Woodroffe, architect, 57, Lincoln's Inn Fields, W.C.
WALKDEN (near Manchester).	New technical school. Inquiries to County Architects, Preston.
WALLSEND.	New police station. John Jackson & Sons, builders.
WARRINGTON.	Infirmary extensions, &c. W. & S. Owen, architects, Caird Street.
WEST KIRBY (Chester).	New Council school. H. Beswick, County Architect, Newgate Street, Chester.
WOODHALL SPA.	Wesleyan church. Wills & Sons, architects, Derby.
WREXHAM.	Presbyterian chapel and other buildings, King Street. W. B. Rees, architect, 3, Dumfries Place, Cardiff.
YEOVIL.	Large foundry. Bird & Pippard, builders, Yeovil. C. Benson, architect, Grove Dene, Preston Road, Yeovil.

Whipple v. the Penpoll Tin Smelting Co., Ltd.—The Court of Appeal on the 2nd inst. heard the appeal of the defendants from a judgment of Judge Taylor in the Liverpool Court of Passage. The action was for the price of a motor and hoist worked by electricity, and the fitting-up by the plaintiff in the defendants' smelting works. The defendants' case was that the hoist would not work, and they rejected the hoist; plaintiff sued for the amount. The learned Judge had given judgment for the plaintiff with costs. The Lord Justices allowed the appeal, and reversed the decision of the Court below, because the hoist did not fulfil the conditions of the contract.

CONTRACTS OPEN and CLOSED.

OPEN.

Belfast.—February 11th. Boilers, superheaters, stokers, &c., for the tramways and electricity department. See "Official Notices" January 18th.

Belgium.—March 30th. The municipal authorities of Liége invite tenders for a central station. For further particulars see our issue of January 25th.

Berlin.—February 20th. The Prussian Government Railways require tenders for insulators, bronze wire, galvanised wire, copper wire, &c. Particulars may be obtained by enclosing 6d. to the Director Eisenbahn Telegraph Amt, Berlin.

Blackburn.—February 18th. Stores for the Electricity and Tramways Committee for one year. See "Official Notices" February 1st.

Bolton.—The Electricity Committee last week instructed the electrical engineer to obtain tenders for a balancer, and prepare specifications for a new engine and generator.

Bremen.—February 18th. Equipment of water turbine works for operating five 400-KW. (each) polyphase generators. For further particulars see our issue of 1st inst.

Brussels.—February 20th. The Belgian State Railways require tenders for one switchboard for five arc lamps, and one switchboard for four arc lamps. Particulars are contained in specification No. 952, which may be obtained from M. de Ludder, 11, Rue de Louvain, Brussels.

Christiania.—February 11th. Tenders for 70,000 insulators for the Norwegian State Telegraphs. For further particulars see our issue of 1st inst.

Christiania.—February 15th. The Norwegian State Railways require tenders for telegraph insulators, 10,000 large and 7,000 small. Particulars in issue of February 1st.

Copenhagen.—February 11th. The Government Railways Department requires tenders for pumps. See issue of January 25th.

Copenhagen.—March 18th. Two steam turbine alternators (three-phase), 2,500 KW. each, for the Corporation. See "Official Notices" January 25th.

Darlington.—February 8th. One 500-KW. dynamo and engine for the Corporation. See "Official Notices" January 25th.

Eastbourne.—February 11th. One 750-KW. steam turbo-alternator and condensing plant for the Corporation. See "Official Notices" January 18th.

Eccles.—February 9th. The Education Committee invites tenders for electric light wiring, fittings, switches, &c., at the Lewis Street Schools. Particulars, on payment of a deposit of 10s. 6d., from Mr. Edwin Parkes, Town Clerk.

Edinburgh.—February 18th. Exhaust steam turbines and D.C. generators for the electricity station in M'Donald Road. See "Official Notices" January 25th.

Germany.—The municipality of Eslohe, Westphalia, is about to invite tenders for the establishment of an electricity undertaking in the town.

Hornsey.—February 20th. Meters, cable, troughing, &c., for the B.C. See "Official Notices" to-day.

Ilford.—February 26th. Feeder booster and switchboard for the U.D.C. See "Official Notices" to-day.

L.C.C.—February 12th. Installation of electric light, motors, bells and fittings, for the Hammersmith Technical Institute. See "Official Notices" February 1st.

L.C.C.—February 19th. Tenders are required by the Council for 300 pairs of maximum-traction swing-bolster trucks. See "Official Notices" to-day.

Middlesex.—February 13th. Tenders for the construction of track-work for electric tramways along Harrow Road, and at Willesden and Acton. Mr. H. T. Wakelam, M.I.C.E., County Engineer, Middlesex Guildhall, Westminster, S.W.

Perth (Western Australia).—March 25th. Lead-covered paper-insulated telephone cable. See our issue of 1st inst.

Roumania.—February 21st. Tenders are invited by the municipality of Focshani for the concession for the electric lighting of the town.

Salford.—February 9th. One motor for driving a 150-KW. alternator for the Electricity Committee. See "Official Notices" January 18th.

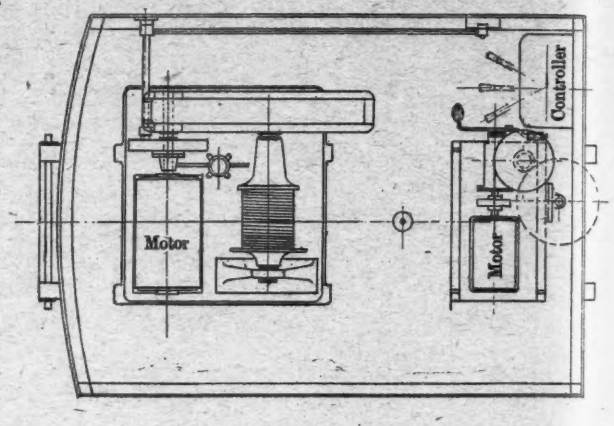
Salford.—February 16th. Supplies for 12 months, including cables, meters, arc lamp carbons, lamps, switches, motors, motor-starters, instruments, &c. See "Official Notices" Feb. 1st.

Salford.—February 16th. The Electricity Committee invites tenders for the purchase of second-hand electric motors, varying in sizes from ½ to 25 B.H.P., D.C. and three-phase. Particulars from the Borough Electrical Engineer.

Spain.—February 18th. Tenders are required by the Vigo municipality for the construction and working of an electric tramway in the town. Particulars can be obtained from El Secretario del Ayuntamiento de Vigo.

Stockton-on-Tees.—February 20th. Stores for the year for the Corporation. See "Official Notices" to-day.

Sunderland.—March 1st. (*a*) Buildings and shaft; (*b*) three-phase turbo-generator, condensing plant, cooling towers; (*c*) water-tube boilers, economisers, &c., for the Corporation. See "Official Notices" to-day.



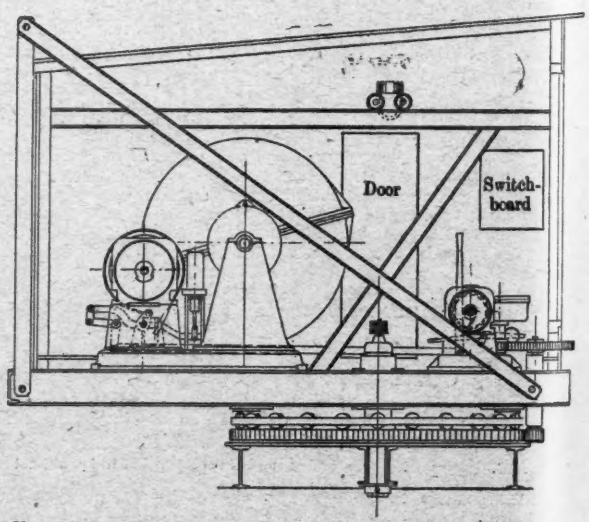


FIG. 1.—ARRANGEMENT OF HOISTING AND SLUING GEAR, 3-TON ELECTRIC CRANE, MIDDLESBROUGH DOCK INSTALLATION.

(See next page.)

Sydney (N.S.W.).—March 6th. Tenders for the supply of 7½ tons of hard-drawn copper wire, 200 lb. per mile. For further details see our issue of January 25th.

Victoria.—April 9th. The Deputy Postmaster-General will receive tenders for telephone material as follows:—No. 1, 2,000 relays to specification No. 136; No. 2, 2,000 registers to specification No. 131; No. 3, 1,000 coin attachments to specification No. 143 and sealed pattern Victoria No. 151; and No. 4, 500 keys to specification No. 138. A deposit of 5 per cent. is required up to the amount of £1,000, and 2½ per cent. for any additional amount exceeding £1,000. Particulars may be obtained at any federal G.P.O.

Walthamstow.—February 8th. Water-tube boilers, coal-conveying plant, engines and dynamos, condensing plant, water purifying and softening plant, and switchboard extensions for the U.D.C. electricity works extensions. See "Official Notices" January 25th.

Wigan.—Tenders for the extension of the boiler house, engine house, and other works at the Corporation generating station. Particulars from the Borough Electrical Engineer.

(Continued on page 232.)

ELECTRICAL CRANES AT THE MIDDLESBROUGH DOCKS.

Now that an important scheme of extensions to the North-Eastern Railway Co.'s dock at Middlesbrough is practically finished, considerable interest attaches to the very complete electrical crane and capstan equipment there provided for cargo handling.

When the dock was first constructed steam cranes were employed, these were, 12 years later, supplemented by hydraulic cranes; in 1903 the steam cranes were superseded by electrical cranes, and a combined power station for supplying both electrical and hydraulic power to all the dock plant, was erected.

The power station is situated on the dock side and contains an installation of six 30 ft. × 8 ft. 6 in. Lancashire boilers, supplying steam at 160 lb. per sq. in. pressure to the electrical and hydraulic engines. The boilers are equipped with Proctor shovel stokers, the hoppers of the latter being supplied with coal by conveying plant. A 384-tube Green economiser is installed in the main flue, and three Watson feed pumps deal with the boiler feed, composed principally of the hot well discharge.

The electrical generating plant (shown in fig. 6) consists of three Belliss & Morcom three-crank compound engines, each developing 360 B.H.P. at 380 R.P.M., and direct coupled to a Siemens bi-polar 240-KW. direct-current generator, giving 400 to 430 volts pressure. Two condensing plants deal with the exhaust steam from the above engines; each has a capacity of 15,000 lb. steam per hour.

Each set consists of a combined surface condenser and compound steam-driven air and circulating pump on one bedplate, and was supplied by Messrs. Carrick & Wardale.

The latter firm also supplied the complete hydraulic installation, consisting of three triple-expansion surface-condensing marine type hydraulic pumping engines and two accumulators for a pressure of 800 lb. per sq. in. The circulating water for the condensing plant is obtained from the dock.

The switchboard for the electrical plant consists of three machine panels, a spare machine panel, one power feeder and one lighting panel, all in marble; the switchgear and instruments were all supplied by Messrs. Siemens. The field and main switches on the generator panels are interlocked with a view to safeguarding the switching operations, the three machines being run in parallel on the bus-bar with the shunt fields excited from the bars. Energy is distributed to the cranes and capstans through a network of fibre insulated lead-sheathed cables laid solid in wooden troughs and some 60 crane connection boxes are installed on the quay side. The distributing cables pass through the lower portion of the box, tee connections being made into the upper part, which contains two fuses and the crane connection contacts.

The lid of the box consists of a chequered plate with a circular hole for the connection socket, the hole being covered by a water-tight steel cap when not in use. The connection socket has a gun-metal hood with two internal gun-metal tongues, which fit into clip contacts inside the box; connection is made to the box by a length of flexible cable, as shown in fig. 5. Some 19 3-ton and five 10-ton cranes, and 26 1-ton pull capstans were provided by Messrs. Cowans, Sheldon & Co.; Messrs. Siemens Bros. supplying

Fig. 2.—View of Electric Gantry Cranes, Middlesbrough Docks.

all the electrical equipments. The principal dimensions of the 3-ton cranes are as follows :—

Height of jib-top pin from quay level	... 60 ft.
Radius of jib	... 44 ft. 9 in.
Speed of lift, 3-ton load	... 150 ft. per minute.
Speed of lift, 1½-ton load	.. 250 ft. per minute.
Revolving speed at hook	... 400 ft. per minute.
Travelling speed	... 30 ft. per minute.
Lifting motor, 50 B.H.P.	... 300 revs. per minute.
Revolving motor, 8 B.H.P.	... 1,000 revs. per minute.

The cranes are of the high-gantry type, shown in fig. 2 constructed so as to admit of wagons and engines passing underneath.

The top of the gantry carries a cast-steel roller path and rack, on which the crane cabin and jib revolves.

The travelling of the gantry can be effected either by hand or electrically; for the latter purpose an enclosed series-wound motor is provided, fixed to the lower framing, and geared to all four trod wheels with a view to avoiding strain

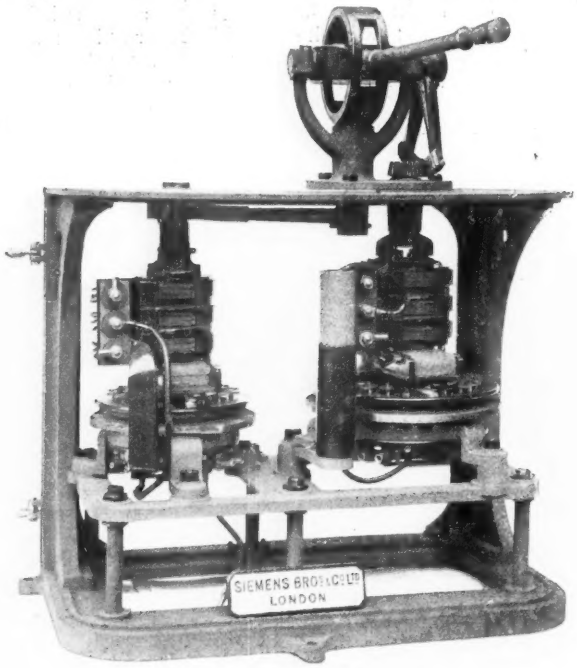


Fig. 3.—Controller for Operating, Lifting and Slewing Motors.

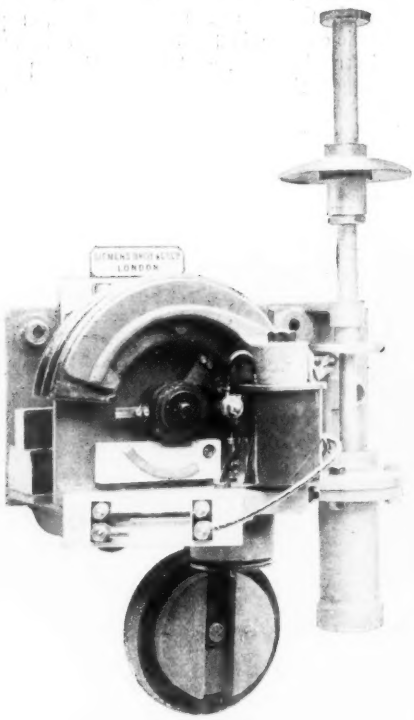


Fig. 4.—Capstan Controller with Pedal.

Fig. 5.—View of Capstan, also of Cable Connection to Crane Gantry.

on the gantry. The switchgear for the travelling motor is placed in a watertight case near the motor, and is controlled by the driver, who holds the key. Actual tests show that it requires some three minutes to travel 30 ft., including all the accompanying adjustments.

The lifting and sluing gear, with their controlling switches, are installed in the cabin, which revolves round a hollow centre pillar.

The latter serves for the entry of the main cables, which pass up and connect to two copper collecting rings, mounted on ambroin and separated by rings of the same material. The collecting brushes consist of two gauze straps, each encircling one ring, the tension being regulated by springs. These straps are attached to terminals supported on porcelain insulators. The lifting gear consists of a 50-B.H.P. series enclosed multipolar motor, with a normal speed of 500 R.P.M., driving through a pinion and spur wheel on the barrel shaft; both pinion and wheel work in an oil bath.

The lifting is done on a single wire rope, winding on to a grooved cast-iron barrel.

The sluing gear is operated by a similar motor to that used for lifting, but of 8 B.H.P.; it drives a worm, actuating—through a worm-wheel, pinion and spur-wheel—a pinion which in travelling round the rack slues the cabin and jib. A brake actuated by a foot treadle is fitted to the first-motion spindle, so that the sluing motion is always under control. Fig. 1 shows the arrangement of a 3-ton crane cabin.

A band brake controlled by an electric magnet is also fitted on the lifting motor shaft. The brake magnet is placed in series with the armature of the lifting motor, and consists of a horse-shoe magnet (with poles arranged like those of a two-pole dynamo) with a solid steel armature of special shape capable of revolving between them. The passing of the current round the field coils tends to move the armature through a right angle. A lever is fixed to the end of the armature, and the brake, which is normally held on to the brake wheel by a weight, is connected thereto by a rod. The movement of the armature lifts the brake and releases the brake wheel. The brake is also connected to a lever which stands at the driver's left, so that it can be operated instantly by hand when necessary.

The controller is of the so-called Universal type, illustrated in fig. 3, and consists of two separate controllers combined and actuated by one handle. One controller actuates the lifting, and the other the sluing, and both are connected by pinions and quadrants to the lever. The latter is connected through a universal coupling, so that when moved in a vertical plane it actuates the lifting, and in a horizontal plane, the sluing controller. Thus it will be seen that the hook follows the motion of the driver's hand, lifting when he raises the lever, and so on. Notches are provided only at the two extremes and the off positions, and, in consequence, the controller may be operated throughout the day without fatigue and its attendant slackness. The resistances are fixed inside the cabin.

The switchboard consists of polished slate, framed in teak, and fitted with a main D.P. switch and automatic cut-out in the lifting circuit, isolating switches in the sluing circuit, fuses, and lighting switches.

The crane cabin and jib are well lighted by fixed and portable lamps, and terminals are provided upon the switchboard, to which may be connected an inspection voltmeter and ammeter. The 10-ton cranes are similar in design to the smaller ones, but somewhat heavier. The sluing motor is of 12 B.H.P.; and the lifting motor, of 60 B.H.P., is both single and double geared to the lifting barrel, the ratios being 8 to 1 and 20 to 1, suited to loads of up to 2 and 10 tons respectively.

The electric capstans are each operated by a 24-B.H.P. enclosed shunt-wound motor running at 1,000 r.p.m., and are capable of exerting a steady pull of 1 ton at a speed of 200 ft. per minute, or of hauling a load of 100 tons along a level road. The capstan head is geared to a worm on the motor spindle; the worm and wheel working in an oil bath. Upon the motor shaft an automatic mechanical brake is fixed, which, when the capstan head is driven by the motor, releases itself; but should the capstan tend to run back through being overhauled by the weight, the brake at once locks itself and sustains the load. Such a brake is absolutely necessary with an electric capstan, as there is nothing to sustain the load, upon the current being cut off, and if the load is allowed to run back a serious accident may ensue. It

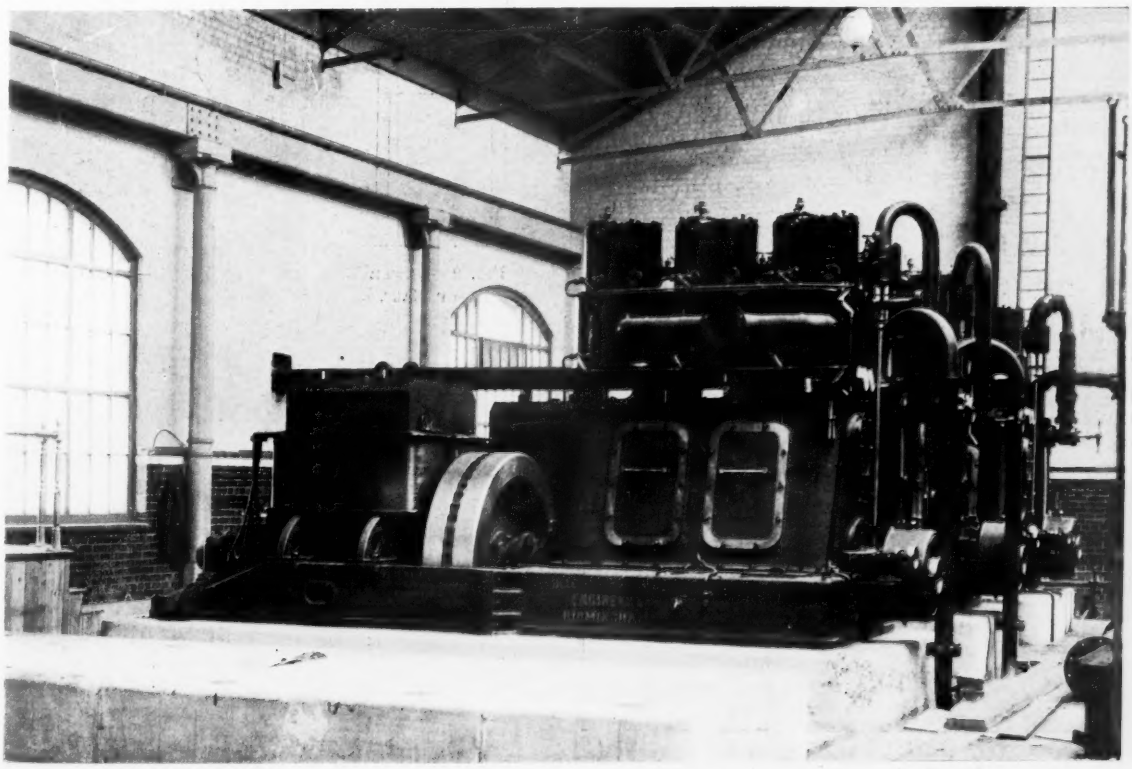


Fig. 6.—Electrical Generating Plant, Middlesbrough Dock Installation.

is also essential that the brake should be automatic so as to claim none of the driver's attention from his work.

The switchgear, shown in fig. 4, consists of a controller with magnetic blow-out, and with overload release gear. The controller is worked by a pedal projecting above the capstan case, and removed when the capstan is out of use. The pedal is connected to a dash pot, which prevents the controller being operated too rapidly when a driver is starting the capstan, but, at the same time, by means of valves in the plunger, allows the controller to return rapidly to the off position. The latter motion is effected by means of a weight, which is lifted as the pedal is depressed. In the event of the capstan being pulled up by sudden overload, the release gear works instantaneously and breaks the main circuit. Upon the pressure being removed from the pedal, the return of the controller to the off position automatically replaces the release switch, and the capstan is ready to start again. The whole of the gear is contained in a water-tight cast-iron case sunk in the ground, the top of which consists of chequered plates flush with the quay side, as shown in fig. 5.

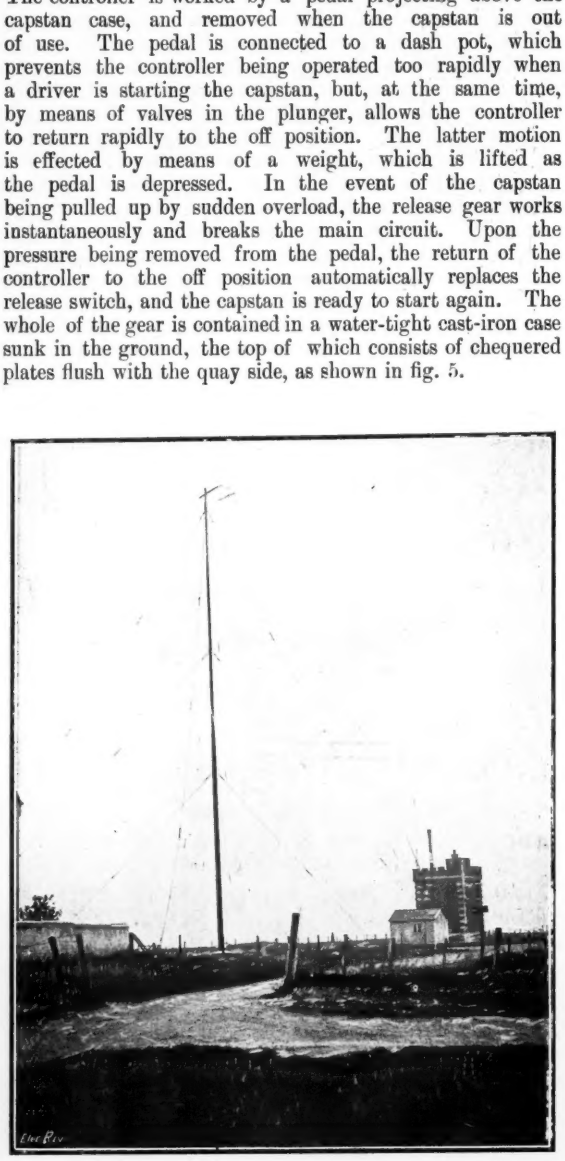


Fig. 1—Hunstanton Radio-Telegraph Station.

In a paper presented before the Chicago meeting of the American Society of Mechanical Engineers by Mr. Vincent L. Raven, of the North-Eastern Railway, in May, 1904, some interesting tests are recorded on the Middlesbrough installation, including a comparison with the hydraulic cranes installed alongside. These show that the electrical cranes have many advantages in operation, being simple, controlled by one handle and safeguarded by overload cut-outs and automatic brakes, quickly manipulated and unaffected by frost. A set cycle of operations was carried out at the rate of 34 per hour with the steam, 36 with the hydraulic and 56 with the electric cranes; rail-loading tests showed a cost with the hydraulic crane of 1s. 6d. per 1,000 ft.-tons, and with the electric of 1s. 2·3d. The cost of operating the electric capstan "on load" was practically equal to the hydraulic, but a test "running light" for 10 mins. showed power costs of ·98d. and 7·2d. respectively, proving that in actual work the electric capstan is the more economical. The total cost for all operations, including interest charges, repairs, wages and power costs, per 100 tons, was with the hydraulic system 327·5d., and with the electric 244·7d., a saving in favour of the latter of 25 per cent.

RADIO-TELEGRAPH INSTALLATION FOR SIGNALLING ACROSS THE WASH.

The English De Forest Co. (now the Amalgamated Radio-Telegraph Co.) recently completed for the Post Office a radio-telegraph installation for signalling over a distance of

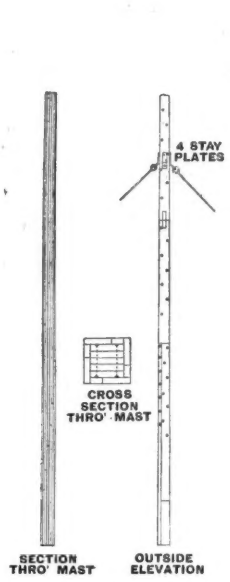


Fig. 2.—Lower End of Mast.

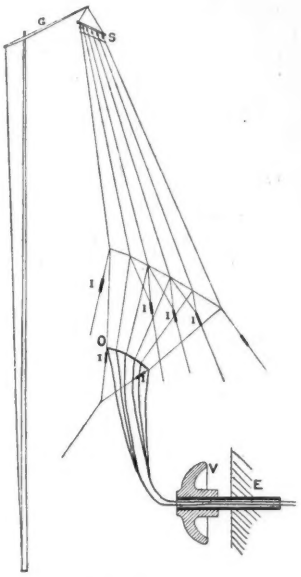


Fig. 3.—Aerial.

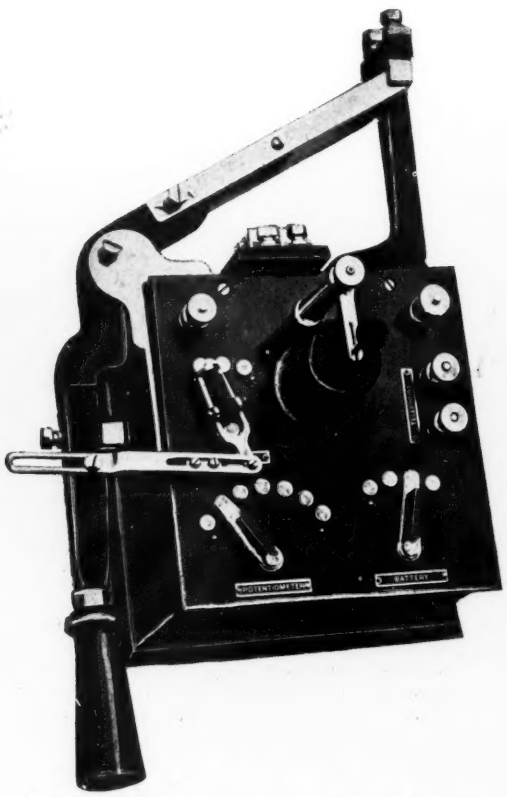


Fig. 4.—Electrolytic Receiver (with "Send" and "Receive" Switch).

16 miles across the Wash, between Hunstanton, in Norfolk, and Skegness, in Lincolnshire. At both cases the plant is installed at the Coastguard Station, situated at the former place on the cliffs near the lighthouse, and at the latter on the sea front about half-a-mile west of the pier.

The installation is primarily for coast communication, but

will also be used by the Post Office for experimental work. Formerly the two stations were connected by an ordinary Morse telegraph circuit; this has been superseded by radio-telegraphy. The operators are Coastguard officers appointed by the Admiralty.

Fig. 1 gives a general view of the Hunstanton Station. The square brick tower is the Coastguard watch house in which the signalling apparatus is fixed, the adjoining wooden hut containing the power plant.

The nearer mast is the radio-telegraph one, that seen beyond the watch house being the station flag-staff. The wireless mast is of a special design introduced by, and as yet confined to, the De Forest systems. It is constructed of rectangular balks of timber bolted together and having an outer framework of planks fixed by stout coach screws. Iron steps are fixed 2 ft. apart, the full length of the mast; and, in addition, there is a rope and pulley arrangement by means of which a man can, when necessary, be raised to the top of the mast.

Fig. 2 shows the lower portion of the mast in outside elevation and in longitudinal and cross-section, as well as the arrangement of the stay plates.

The mast is 120 ft. in height, and 14 in. sq. at the butt, tapering to 8 in. at the top.

There are three sets of four rectangularly-arranged stays, the four in the upper set consisting of 7/14, those in the middle set of 7/12, and those in the lower set of 7/10½ galvanised iron wire, all being terminated on substantial stay anchors.

The stays are insulated by means of 2 ft. lengths of ash wood 2 in. × 1½ in. in section, four lengths being inserted in each of the upper stays, three in each of the middle set, and two in each of the lower stays.

The aerial consists of six 7/20 tinned copper wires. Each wire is attached to a glass insulator, which is fixed to a spar S (fig. 3) suspended by stout rope to a gaff G. The gaff is attached to the top of the mast by a wire-rope halyard, passed over a pulley and fastened to a wooden post set in concrete. This admits of the aerial being readily lowered and raised. As will be seen from fig. 3, the six antennæ wires are united near the top, the connection being made by a copper wire. From this point the wires spread out, being held apart by rope guys, in each of which is a hard rubber insulator (I, fig. 3). Then they converge, and are fastened near the tower to a short oak "spreader" O. From O the antennæ wires are carried in two equal sections, each being connected to two insulated wires which pass through a large glass insulator V, and a hard rubber tube E, into the operating room, being there connected to a small spark gap G (fig. 5).

A special arrangement inside the building renders possible the direct earthing outside of the aerial during thunderstorms.

Fig. 5 shows, in skeleton, the connections of the transmitting circuit. The source of power is a small alternator M, having a directly coupled exciter, and driven from a small Capel oil engine. These are located in the wooden hut seen in fig. 1. The alternator gives a current of 9 amperes at 110 volts, the periodicity being 60 per second.

The Leyden jars J_1 are for the purpose of absorbing any high voltage pulses which might be conveyed from the oscillating circuit while transmitting. The jars are of a capacity sufficient to prevent any oscillations of the kind causing damage to the windings of the alternator.

The alternator is joined to the primary P of a transformer, through an adjustable resistance coil R, and a key T. The voltage is stepped up to about 25,000. The secondary coil S of the transformer is connected to a set of six Leyden jars J, the plates of which are joined to the main spark gap D, and through the contact arm C_1 to a portion of an inductance coil I_1. This coil is also connected by means of the contact arm C_2 to the smaller gap G, known as the "aerial spark gap," the other terminals of which are, as already mentioned, connected to the two portions of the antennæ A. One end of the inductance coil is insulated, the other end being earthed.

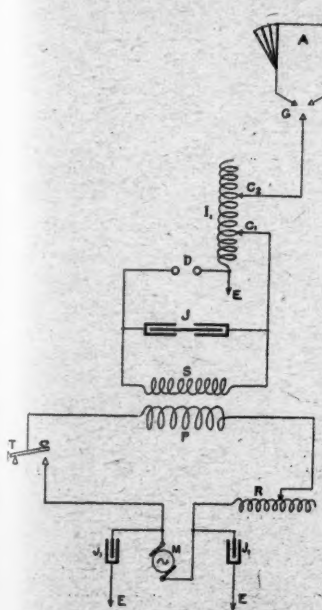
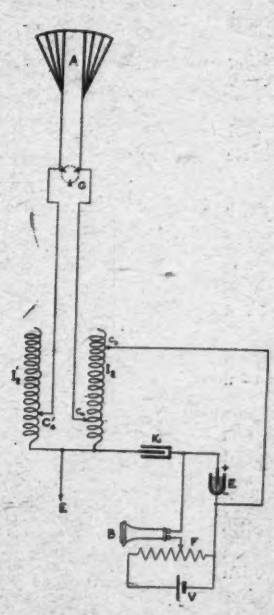
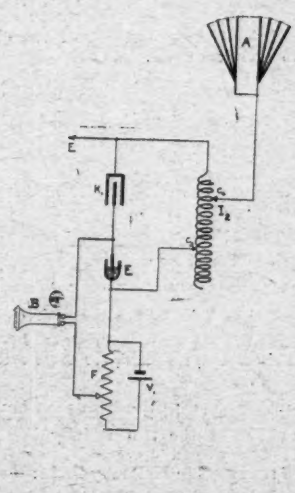


Fig. 5.—Skeleton Diagram of Transmitting Circuit.





Figs. 6 and 7.—Skeleton Diagrams of Receiving Circuit.

Fig. 6 shows, in skeleton, the connections of the receiving circuit.

One side of the antennæ loop is connected to an adjustable inductance coil I_2, the other to a second adjustable inductance I_2'.

The values of the inductances I_2 and I_2' can be so adjusted in receiving that oscillations are set up in the aerial loop and are communicated to a circuit composed of an electrolytic receiver E±, the condenser K_1, and a portion of the inductance coil I_2.

In circuit with the electrolytic receiver are a battery V, a potentiometer F, and a telephone B. The received oscillations give rise to variations in the resistance of the electrolytic receiver, causing corresponding variations in the battery current, and so communicating clicks to the telephone. The clicks correspond to the received trains of waves, the latter being dependent on the movement of the transmitting key T (fig. 5). A dot sends out a short train and a dash a longer train of waves, and in this way messages in the code are received in the telephone.

Arrangements can be made for coupling the two halves of the antennæ together and using only the inductance coil I_2. This is shown in fig. 7.

Fig. 4 gives a general view of the piece of apparatus carrying the electrolytic receiver, and containing also the battery and potentiometer shown in figs. 6 and 7, as well as having attached to it the "send" and "receive" switch, the latter being shown in the figure in the "receive" position. The double head-gear telephone used for reception is attached to the two lower terminals on the right-hand side. Immediately below these terminals is a switch by means of which either one or two or three cells may be brought into use; and to the left of this switch is another for use with the potentiometer.

As an alternative to reception by telephone, there is provided a Morse recorder, which is actuated by a Maskelyne wireless receiver. The wave detector employed with this

receiver is that known as the "conjunctor." This consists of a small glass tube containing a short slightly oxidised steel cylinder with conical ends, on which cups are formed, the cylinder being supported by two cylindrically-shaped pieces of steel, highly polished and rounded and carried on the ends of two small metal rods, the other ends of which project from the glass tube.

The working of the Wash radio-telegraph installation commenced on December 1st last, and has been most successful, a speed of about 35 words per minute having been attained on the electrolytic receiver and telephone circuit.

We are indebted to the courtesy of Mr. J. Gavey, C.B., engineer-in-chief to the Post Office, for placing information and diagrams at our disposal for the preparation of this article.

CONTRACTS CLOSED.

Barnstaple.—The T.C. has accepted the tender of the liquidator of the A.B P. Co. for the supply of negative sections, negative and positive plates, and glass boxes for the accumulators, at £47 3s. 6d.

Bradford.—Messrs. W. T. Garnett & Co., Barkerend Mills, Bradford, have placed the order for the complete lighting installation at their new offices and warehouses, and for the wiring for motors and a complete telephone installation, with Mr. Chas. Pullan, Bradford.

Cheshunt.—The tender of Messrs. Dick, Kerr and Co., Ltd., has been accepted for the construction of the electric tramways from Cheshunt to Waltham Cross.

Derby.—The following tenders have been accepted by the Corporation electricity supply department:—

Babcock & Wilcox, Ltd.—Boilers, &c., £7,480.
E. Green & Son, Ltd.—Economiser, £830.
Musgrave & Co., Ltd.—Induced draught plant, £1,650.
Chain Belt Engineering Co.—Coal bunkers, elevators, &c., £3,772.
Blackwell & Co., Ltd.—Construction of tramways (Ashbourne Road and Uttoxeter Road), £29,331 4s. 6d.

Hull.—The Corporation E.L. Committee has accepted the tender of the Lahmeyer Electrical Co. for the supply of a 500-kw. steam dynamo and Belliss engine, at £3,915.

Leyton.—The U.D.C. has accepted the tender of the Lahmeyer Electrical Co. for the supply of cables, at £1,244, and that of Messrs. Edgar Allen & Co., Sheffield, for cross-overs and fishplates, at £216 10s.

London.—L.C.C.—The L.C.C. has received the following tenders for the reconstruction of the two railway bridges at Highbury station and in Holloway Road respectively, in connection with the conversion of the tramways in Holloway Road:—

W. Muirhead & Co.	(recommended)	£10,582
Pedrette & Co.		10,748
C. Wall, Ltd.		10,934
Dick, Kerr & Co., Ltd.		10,939
G. Hay & Co.		11,085
A. Fasey & Son		11,101
B. E. Nightingale		11,129
Greig & Matthews		11,175
John Cochrane & Sons		11,455
Heenan & Froude, Ltd.		11,738
A. Handyside & Co.		11,922
J. A. Ewart		13,209

Engineer's estimate £11,953.

The following firms have tendered for the supply of magnetic brake equipments for the remaining 170 cars not fitted in this way:—

British Westinghouse Co.	(accepted)	£8,485
British Thomson-Houston Co.		8,910

New South Wales.—The Postmaster-General has accepted tenders for the construction of eight-way stoneware conduits at North Sydney, as follows:—Supply and laying complete of 17,824 ft. of stoneware conduits, 10d. per duct foot. Construction of four manholes complete, 5 ft. × 4 ft., £17 per manhole. Construction of two manholes complete, 3 ft. 4 in. × 3 ft., £14 2s. 6d. each. Supply and laying complete of 4-in. drainage to six manholes, £2 5s. each. (Gunton & Knox, Carlotta Street, Gorekill.)

Poplar.—The B.C. has placed an order with Messrs. Bruce Peebles & Co. for a rewound motor, at £450.

Wimbledon.—The T.C. has accepted, at £310, the tender of Messrs. S. S. Stott & Co. for an electrically-driven screen.

Wirral.—The Joint Hospital Board has accepted the tender of Messrs. Collins & Price, of Wirral, for installing the electric light at the Fever Hospital, at £189 15s.

Metropolitan Asylums Board.—The following tenders have been received for the installation of electric bells and telephones at the North-Eastern Hospital:—

W. M. Glendinning, Rathgar Road, Brixton	(accepted)	£400
Lea & Warren		515
Baxter & Impey		520
Speedy, Eynon & Co.		580
The Bell Telephone & Electric Co.		581
W. J. Fryer & Co.		590
J. Boulting & Sons		596
W. J. Furse & Co.		599
National Telephone Co.		609
The Electrical Engineering & Maintenance Co.		610
Cross & Cross		616
J. Bryden & Sons		620
The British Home & Office Telephone Co.		629
T. Potter & Sons		633
J. O. Grant & Taylor		635
Bromley, Batstone & Kirk		641
Cox-Walkers, Ltd.		650
The Private Wire & Telephone Installation Co.		660
Cowtan & Sons		655
Shalders & Davis		670
Sweet Bros.		689
C. Pullan		693
Electrical Installations, Ltd.		698
Vaughan & Cook, Ltd.		720
A. G. Barton		783
G. Weston & Sons		789
T. Hiscock		830
Jackson Bros.		859
F. A. Glover & Co.		959

The engineer-in-chief's estimate was £500.

FORTHCOMING EVENTS.

To-day's Events (Friday, February 8th).—At 8 p.m. Physical Society. Annual General Meeting. Presidential Address. Mr. A. Russell on "The Magnetic Fields and Inductive Coefficients of Circular, Cylindrical, and Helical Currents."

Armstrong College Engineering Society.—Mr. C. R. M. Young on "Brakes."

Saturday, February 9th.—At 2 p.m. North of England Institute of Mining and Mechanical Engineers. Meeting.

Institution of Electrical Engineers (Manchester Students). Annual Dinner.

Junior Institution of Engineers. Anniversary Dinner at the Hotel Cecil.

Monday, February 11th.—At 8 p.m. Institution of Mechanical Engineers (Graduates). Dr. H. S. Hele-Shaw on "Aerial Navigation."

At 8 p.m. Society of Arts. Cantor Lecture by Prof. J. W. Gregory, D.Sc., on "Gold Mining and Gold Production."

Tuesday, February 12th.—At 8 p.m. Institution of Electrical Engineers (Glasgow). Mr. F. Walker on "Remote Control Switchgear."

At 8 p.m. Institution of Civil Engineers. Discussion on Col. R. E. B. Crompton's paper on "Modern Motor Vehicles."

Wednesday, February 13th.—At 7.30 p.m. Institution of Electrical Engineers (Birmingham). Meeting.

At 8 p.m. Society of Arts. "Motor-Omnibuses," by Lord Montague, of Beaulieu.

Association of Engineers-in-Charge. Mr. W. F. Goodrich on "Fuel Economies and Steam Generation."

Thursday, February 14th.—At 7.30. Birmingham and District Electric Club. Mr. J. G. Smith on "Electric Lighting: Present, Past and Future."

Friday, February 15th.—At 7.30 p.m. Institution of Electrical Engineers (Manchester Students). Mr. W. Browning on "Notes on Electrical Conductivity."

At 8 p.m. Institution of Mechanical Engineers. Annual General Meeting. Discussion on the Report to the Alloys Research Committee on the Properties of the Alloys of Aluminium and Copper.

Saturday, February 16th.—At 3 p.m. Royal Institution. Prof. J. J. Thomson on "Röntgen, Cathode and Positive Rays."

Institution of Electrical Engineers (Manchester Students). Visit to Liverpool and Southport Electric Railway.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

The following orders are issued:—

Saturday, February 9th.—N.C.O.'s mess dinner at the Monico.
Monday, February 11th.—"A" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.
Tuesday, February 12th.—"B" Company, recruits' infantry drill, 6 p.m.; technical instruction, 7 p.m.
Wednesday, February 13th.—"A" Badge examination for "C" and "D" Companies.
Thursday, February 14th.—"C" Company, technical instruction, 7 p.m.
Friday, February 15th.—"D" Company, recruits' infantry drill, 6 p.m., technical instruction, 7 p.m.

J. H. S. Phillips, Captain,
For O.C.E.E.R.E. (V.).

Richmond v. L.U.T. Co.—At the Brentford County Court, on January 30th, James Stacey, a carman, sued the London United Tramways Co., Ltd., for damages for personal injuries. He was driving a van through Brentford High Street, and as he was pulling out from the side of the road a car crashed into it, throwing him down and permanently injuring him. After hearing the defence of contributory negligence the jury found for the plaintiff, and awarded him £300 damages.

NOTES.

Apprentice Frauds.—Francis Delme Radcliff, an electrician, was recently charged at the Guildhall with defrauding an apprentice. It appeared that he had an office in Fenchurch Street, and took a number of apprentices, whom he undertook to teach the business of electrician. Premiums of from £5 to £20 were paid, but no business was done and no instruction given. Accused was remanded on bail.

The National Physical Laboratory.—We learn from the *Times* that a Committee has been appointed by the Board of Treasury to inquire into the work of the National Physical Laboratory, with special reference to the character of the tests undertaken there and the lines on which any further development of the work of the laboratory should proceed.

Parliamentary.—At the sitting of the Metropolitan Water Board on Friday it was resolved to petition against the following Bills:—London and North-Western Railway, Lower Thames Tunnel Railways, L.C.C. Tramways, London United Tramways, L.C.C. Electric Supply, Administrative County of London Electric Power, London Electric Supply, North Metropolitan Electric Power Supply, and the West Ham Corporation Tramways Provisional Order.

Educational Notes.—Salford Technical Institute.—Messrs. Royce, of Trafford Park, Manchester, have sent 27 of their apprentices to Dr. Rhodes's class on "Electric Traction," which began on January 16th. The firm pay the fees of their apprentices, and receive from the Institute monthly returns of their attendance and work.

Messrs. Mather & Platt have decided to refund the fees of those of their day apprentices who, by special arrangement, are attending at the Institute during two half-days per week. In cases of special ability the firm propose to pay double the amount of the fees as a further incentive to progress. The apprentices who are selected to attend the classes receive their ordinary wages for the time during which they are at the Institute. These firms are showing an excellent example.

City and Guilds of London Institute.—A course of six lectures on "Pyrometry" is to be given by Mr. C. R. Darling at the City and Guilds Technical College, Finsbury. Special attention is to be devoted to the modern commercial applications of the subject, which are now both numerous and important. For particulars see our advertisement pages.

The annual distribution of diplomas, prizes, and certificates to the successful students attending the colleges and schools conducted in London by the City and Guilds of London Institute was held at the Mansion House on January 29th. The Lord Mayor, who was accompanied by the Lady Mayoress, presided, and among others present were the sheriffs, Sir J. Wolfe Barry, Sir William White, Sir A. W. Rücker, Sir W. Prideaux, Sir Owen Roberts, Sir W. Bousfield, Sir Philip Magnus, M.P., Sir John Watney (hon. secretary), Mr. S. S. Gladstone (treasurer), Prof. Dalby, Prof. S. P. Thompson, Mr Frith, and Mr. F. Y. Golding. The Lady Mayoress presented the prizes.

North of England Institute of Mining and Mechanical Engineers.—The Council, in collaboration with the Council of the Armstrong College, has arranged a course of lectures for colliery engineers, apprentice mechanics, and others, to be delivered at the Armstrong College, Newcastle-on-Tyne. The course will extend over three winter sessions, during which period lectures have been arranged as follows:—(1907 8) "Theoretical Electricity," by Mr. H. Morris-Airey; "The Steam Engine," by Mr. H. R. Cullen; "Electrical Engineering," by Prof. W. M. Thornton, D.Sc.; "Haulage and Winding," by Prof. H. Louis. (1908-9) "Transmission of Power," by Mr. H. R. Cullen; "Pumping and Ventilation" and "Mining Machinery," by Prof. H. Louis; "Metallurgy of Iron and Steel," by Mr. H. Dean. (1909-10) "Machine Drawing" and "Strength of Materials," by Mr. H. R. Cullen; "The Chemistry of Fuel," by Dr. F. C. Garrett; "Experimental Mechanics," by Mr. H. Morris-Airey.

Institution Notes.—Society of Engineers.—The first ordinary meeting for the present year was held on February 4th, at the Royal United Service Institution, Whitehall. Mr. Maurice Wilson, the President for 1906, presented the premiums awarded for papers read during that year. The President for the present year, Mr. R St. George Moore, then proceeded to deliver his inaugural address, on the *status* of professional or consulting engineers, with suggestions for its improvement.

Institution of Electrical Engineers (Glasgow Section).—The annual smoking concert was held on Saturday last.

Institution of Electrical Engineers (Birmingham Section).—The first annual dinner of this Section will be held at the Grand Hotel, on Wednesday, February 27th, 1907, at 7 o'clock for 7.15. Applications for tickets should reach Mr. H. B. Matthews, hon. local secretary, not later than Wednesday, February 20th.

Bradford Colliery Installation.—In our article in last week's issue, we inadvertently credited the India-Rubber, Gutta-Percha and Telegraph Works Co., of Silvertown, with supplying the cables; these were, it appears, supplied by the old Telegraph Manufacturing Co., of Helsby, now the British Insulated and Helsby Cables, Ltd.

Trade Dispute.—A public meeting was held in the Loughborough Town Hall on the 3rd inst., in connection with the dispute at the Brush Electrical Engineering Co.'s works. Mr. C. Kinggate, president of the United Society of Coachbuilders, who addressed the meeting, referred to the recent abortive Board of Trade negotiations, and mentioned that the matters in dispute were stationary.

Appointments Vacant.—An assistant mains superintendent is required at Rochdale at £78 rising to £104; an assistant lecturer in physics is required at the Battersea Polytechnic at a salary of £180; junior assistant engineers are required by the Yorkshire Electric Power Co; the T.C. of Oban requires a resident electrical engineer at a salary of £150 per annum. See our advertisement pages to-day.

A Kingston Wiring Contract.—Referring to our note of January 28th on the wiring of Richmond Road Council school, we learn that 35 tenders were submitted. The highest was £482, and the lowest, which was accepted, was £165. As the cost of the material alone, according to the specification, would amount to more than the latter figure, the question arises whether a mistake was made in the tender; it will be noticed that the highest tender is almost three times the lowest.

Nitrogen from the Air.—It is reported that Profs. J. von Krowalski and I. Moscicki, of the Fribourg University, Switzerland, have developed a greatly improved process for the electrical manufacture of nitric acid from the atmosphere.

General Electric Co.'s Annual Dinner.—On Saturday last the seventeenth annual dinner of the General Electric Co., Ltd., was held at the Trocadero; seats were provided for about 100 members of the staff and about 300 guests, including consulting and central station engineers, contractors and other of the company's friends. Mr. H. Hirst presided, and was supported by Mr. J. Gavey, C.B., and Mr. Robert Hammond. A musical programme was performed during dinner by the Universal Orchestra, and afterwards a concert was given, in which Mr. Arthur Prince's excellent ventriloquial performance was the chief item.

After the chairman had proposed the loyal toasts, which were duly honoured, Mr. Philip Dawson proposed "The Navy and the Army," pointing out that while our commerce was flourishing, as exemplified by the G.E. Co.'s prosperity, we could not keep it without the Navy. Electricity had now become a very important factor in naval warfare, and was highly valued by the officers in charge. In reply, Captain G. T. Wingfield referred to the great changes in *materiel* and *personnel* in the Navy during recent years, and to the new and somewhat experimental system of combined training. The Army also was the subject of experiment.

Mr. Hirst next extended a hearty welcome to the guests, and remarked that the electrical manufacturer was a much maligned person; he was expected to have all the virtues and accomplishments, combined with financial genius, diplomacy and strategy. The manufacturers of this country were as well equipped, and the workmen as highly skilled, as those of any foreign country—yet all was not as it should be with British industries, though the G.E. Co. had held its own. The last had been a bumper year for imports and exports—yet certain companies had failed to prosper under present conditions, while foreign concerns declared large dividends, after providing for depreciation on a generous scale. Here, in the technical Press, there were numerous advertisements of situations *wanted*; abroad, there were numerous situations *vacant*. Why? He believed in Tariff Reform. Manufacturers ought to combine and state their grievances. Already Mr. Lloyd-George had promised to introduce a much-needed reform in the Patent Law, and was prepared to be guided by facts—let the manufacturers bring forward the facts. Necessarily capital had not flowed freely into electrical enterprise; they had been obliged to rely upon municipal enterprise—to which they were grateful, through it had a retarding effect on progress, for they always had to prove previous experience. By the time municipal men had been educated an election took place, and new men came in. Consulting engineers should be given greater power. Regarding the labour question, while he approved of combination for many useful purposes, he would fight to the utmost against the trade union tendency to level labour down to the level of the lowest. The Socialist element was the dangerous feature, tending to degeneracy and the repression of genius. In conclusion, Mr. Hirst proposed the toast of "The Guests."

Mr. J. Gavey, in his reply, reviewed the wonderful advances that he had seen taking place during his career, and speculated on the future developments in electrical science. He acknowledged the indebtedness of the Post Office Engineers to the willing co-operation of manufacturers.

The Mayor of Salford (Ald. Frankenburg) said that manufacturers should pass through the mayoral chair—it would do them good. He dared not speak of Tariff Reform in Manchester, but here he was unchained, and he remarked that the trade statistics for 1906 were ridiculous—the increase was simply due to a rise of from 20 to 50 per cent. in the price of materials. Trade might be good for manufacturers but bad for the workpeople.

Mr. Robt. Hammond, who spoke in place of Dr. Glazebrook, referred on behalf of the latter to the splendid struggle of the G.E. Co. in the carbon-making industry, and passed humorous comments on the items set down in the concert programme. He concluded by toasting "The General Electric Co."

Mr. Railing, replying on behalf of the company, said they always tried to combine personal friendship with business relations, and had done their best to improve the moral and social condition of

their workpeople. He proposed the health of Mr. Gustav Byng, to which there was a hearty response.

Mr. Bevis proposed the health of "The Staff," upon whom he impressed as a watchword "Efficiency." Mr. Cash briefly replied, and Mr. M. Solomon, assuming the part of spokesman for the fair sex, who constitute a considerable proportion of the staff, expressed the hope that they would at some future date share in the dinners and take a greater part in the business of the company. After an amusing illustration of the improved style of letter-writing that would probably result, he expressed the loyalty of the staff to the company.

Mr. Mordey proposed "The Chairman," with a message to Mr. G. Byng, and in his reply, Mr. Hirst communicated a kindly message from Mr. Byng to the staff; the guests were pleased to learn that he had benefited in health, and hoped to return to work in the spring.

The concert then followed, commencing at a rather late hour. Many old friends, as usual, foregathered at the dinner, which has become quite a notable event in the electrical world, and all appeared to enjoy the entertainment very heartily.

A "Times" Contributor and Tramway Statistics.—The writer of the "Electrical Notes" in the *Times* Engineering Supplement says that some remarkable deductions may be made from the annual return relating to tramways, to which we referred in our leading columns last week. He discusses, among other points, the energy used by corporation as compared to company cars. The municipal cars consumed 231,000,000 units for 154,000,000 car-miles, and the company cars only 84,000,000 units for 89,183,683 car-miles. "This disproportion," he adds, "is surely worthy of close investigation." But the writer might have made his own investigation, either from the official return or from our own selection from the figures. It required only a *superficial* investigation to see that a very large number of *horse* cars are owned by the companies, and we may tell him on good authority that, as a general rule, these do not consume any units of electricity at all. The figures are not electrically comparable unless all the horse-car-miles on both sides are excluded from the reckoning.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Engineers.—The Tonbridge U.D.C. on January 31st appointed Mr. M. P. Plunkett, of Oban, as electrical engineer, at a salary of £150 per annum, rising by £25 a year to £250. He will be allowed to have one pupil.

Mr. W. E. Claret, late of the Ilford U.D.C. Electricity Works, has been appointed chief assistant engineer to the Smithfield Markets Electric Supply Co., Ltd., London, E.C.

The Salford Electricity Committee, at its last meeting, appointed Mr. V. A. H. M'Cowen (subject to the approval of the Borough Council) as electrical engineer, in succession to Mr. Taite. Mr. M'Cowen is engineer to the Belfast Corporation, with which he has been for the last 12 years. He designed and carried out at a cost of about £260,000 the whole of the Belfast City electricity scheme for lighting and power purposes. He also designed and superintended the whole of the scheme for the electrification of the Belfast city tramways. The Belfast City Council has offered to increase the maximum salary of Mr. M'Cowen from £800 to £1,000 per annum with the view of inducing him to retain his position as electrical engineer to the Corporation.

Mr. J. W. Speight, of the Metropolitan Borough of Woolwich Electricity Works, has resigned, having been appointed assistant station superintendent at the Leyton U.D.C. Electricity Works. There were 241 applications for the position.

Mr. J. A. Forde has been appointed engineer and manager to the Isle of Thanet Electric Tramways and Lighting Co., Ltd.

Mr. Alexander Walker, St. John's Road, Deptford, has been appointed charge engineer to the Southwark electric lighting undertaking. There were 83 candidates for the position, the salary attached to which is £2 5s. a week, rising to £2 15s. a week.

Mr. A. R. Grundy, engineer-in-charge to the Bermondsey undertaking, has been appointed electrical engineer to the Royal Mint, Calcutta.

The Worcester T.C. is recommended to appoint Mr. Bemrose, senior assistant as chief assistant, his salary to be increased to £2 10s. per week at the expiration of six months.

Mr. Philip F. Wayman, who is leaving the Colchester Corporation Electricity Works to take up a position in Canada, has been presented with a writing case by the staff.

Mr. Alfred S. Blackman, electrical engineer at Bradford, who is leaving to take up a like position at Sunderland, has been presented by the staff with a solid silver rose bowl and a pair of silver vases.

The Dover T.C. has appointed Mr. H. E. Osborne senior charge engineer at the electricity works, at a salary of £100 per annum, rising on September 1st, to £110.

The Manchester T.C. has been recommended to grant the following increases of salary:—Mr. McKenzie, resident engineer, Stuart Street station, from £350 to £400 per annum; Mr. Lee, mains engineer, from £350 to £375; Mr. Hughes, secretary to the electricity department, from £400 to £425. The T.C. has also been recommended to increase the salary of Mr. Oakes, tramway traffic superintendent, from £400 per annum to £500.

The Rochdale Electricity Committee has decided to recommend an increase in the salary of the electrical engineer, Mr. C. C. Atchison, of £50 per annum.

Electric Tramway Officials.—Major W. T. Marshall, V.C., has taken up the duties of manager of the Wemyss tramway system. Major Marshall served throughout the Egyptian War of 1882, was present at Tel-el-Kebir, and also went through the Soudan campaign of 1884. The Victoria Cross was won by him in the memorable charge at El-Teb. Major Marshall was one of the band who sat tight during the siege of Ladysmith, and for this and other engagements has the Queen's medal and four clasps.

Mr. J. S. Smyth, who has acted as manager of the Siamese Tramways Co., Ltd., for nearly two years, has been appointed manager of the Bangkok Dock Co., Ltd.

Mr. R. Withycombe, the superintendent of the overhead equipment in the West Ham Corporation Tramways Department, has recently been appointed to a more lucrative position in the firm of Messrs. Estler Bros. On the 2nd inst. he was presented, on behalf of the official staff, with a handsome oak smoker's cabinet, the presentation being made by Mr. H. E. Blain, tramways manager, and later in the day the employés in the overhead equipment gangs, which had worked under him, presented him with a large fountain pen, this presentation being made by Mr. H. M. Brockbank, foreman lineman.

General.—It is announced by Reuter's agent at Sydney that Mr. Johnson, assistant engineer to the Great Northern Railway Co., England, has been appointed Chief Commissioner of the New South Wales railways. Mr. Kirkcaldie and Mr. Richardson, local railway men, have been appointed Assistant Commissioners.

The fourth annual dinner of the staff at the Carlisle Corporation electricity works was held on February 1st. Mr. C. D. Burnet (electrical engineer) presided, supported by Mr. Scurfield (deputy engineer), Mr. Cook (manager of the Carlisle Tramways), Mr. Holroyd (manager of the National Telephone, Carlisle) and others. There was a large attendance of employés.

The eleventh annual dinner of the employés of the Norwich electricity department took place on the 1st inst. The city electrical engineer (Mr. F. M. Long) presided, and was supported by members of the committee. After the dinner a musical programme was gone through, the proceedings being in every way successful.

Obituary.—We regret to record the death, at the age of 73, of Prof. D. I. Mendeleeff, the famous Russian chemist who discovered the Periodic Law.

CITY NOTES.

Central London Railway Co.

The twenty-third ordinary general meeting of the proprietors of this company was held on Wednesday at the Holborn Restaurant, Sir Henry Oakley in the choir.

The Chairman, in proposing the adoption of the report, said that no new capital had been created in the half-year. They had only expended about £6,000 on capital account, £4,000 of which was for the provision of a sub-station at the Post Office, which they found necessary to ensure the continuity of the working of the system. He would like to say a word with reference to the first locomotives of the company. They were found after a short time to be so heavy, and the vibration they created was so excessive that they were obliged to abandon them. There were 26 of them, which were found to be practically useless. They had kept two in case of emergency, and they advertised the remaining 24. Two only, however, were sold, and those were bought by way of experiment, and he was afraid the purchasers found the experiment so unprofitable that they declined to buy any more. As the stock was lying idle, and gradually deteriorating, the board decided to dismantle them and sell the materials. That had been done, and happily there was a great amount of copper, brass and steel in them, which material at the present time was fetching good prices. When they had received payment for the material, they would have to deal with the account which stood at a debit of about £74,000. He did not think that that amount should be debited against the current proprietors. It was a charge on the original undertaking, and found not to be useful for the purpose intended, and if there was a loss of £40,000 or £50,000 on it, it ought to be written off in some way, but he thought it would have to be spread over a series of years, so as to avoid the whole of the burden being cast on the present proprietors. In the current half-year they contemplated a further capital expenditure

of £35,000, which included the provision of a large engine to be added to their plant at Shepherd's Bush, and the sinking of a well to provide their own water for condensing purposes, instead of buying it from the Water Board. Then they would have to pay for the exchange subways at Oxford Circus and Tottenham Court Road. Turning to the revenue at first sight, it appeared to be somewhat discouraging, because there was a loss of a million passengers and of £750,000 odd in receipts. Although that was disappointing to an extent, yet very careful watching of the business satisfied the board that there existed a solid sub-stratum of business on the line which was not affected by the competition which had recently arisen, and they were assured that the soundness and future prosperity of the undertaking had not been shaken in the slightest degree. Their trouble lay in the competition of the motor-omnibuses. Taking Tottenham Court Road station as an example, where there had been a loss of 10,000 passengers a week, they found that motor-omnibuses passed east and west at intervals of between 1 and 1½ minutes. The fare to the City was 1d., and the same to the Marble Arch, whereas on their railway a passenger would have to pay 2d. in either case. As to the remedy, they would all recollect that when the company was started the average fare of 2d. was very much applauded by everybody, who thought it a very good thing, especially when it was coupled with the ready and facile way of conducting their business, by which a passenger, after purchasing his ticket and dropping it into a bowl, was free to get out wherever he wanted. It was clear that if they were to adopt 1d. fares, that system would have to be put a stop to, and they would have to come down to the regular railway routine of issuing tickets and having them examined and collected. Whether that would be more profitable to them was a question he would not for the moment answer, because the board had been for some time, and were still, giving it their gravest consideration. Sir George Gibb was making the experiment on the District Railway. He had reduced the short-distance fares and increased the long-journey fares, and when they had seen the effect of that experiment they would be able to speak more positively on the question. There was this satisfactory feature—that during the last month or six weeks the loss of passengers had not been increasing, and it might be that the diversion had only affected the fringe of their traffic and not the substance of it. He was glad to say that the exchange station at Oxford Circus with the Bakerloo Railway was doing very well. It brought them about 3,000 passengers a day, which number was daily increasing, and they believed that the Tottenham Court Road Station would do as much or more for them, and therefore, before making any reduction in their fares, they were anxious to wait and see the effect of these exchange stations as well as to learn the experience of the District Co. There had been 972,000 less passengers in the half-year and 62,406 more workmen, making a net loss on the 2d. passengers of 1,074,000 out of a total of 20 millions. With regard to the expenditure, they had done their best to keep it down, and they had largely succeeded in reducing the cost of working, despite the fact that coal had gone up 1s. 6d. a ton. The item of rates and taxes had increased by £1,400, and the sum now payable under that head—£16,000—practically represented 20 per cent. of the dividend. He considered that the system under which railways were taxed was oppressive in the highest degree, as they were assessed on their earnings, less their expenses, the practical result being that the more economically they conducted their business the more they had to pay in rates. Their average receipt per passenger was 1·84d., which was accounted for by the loss on the workmen, whom they carried at 1d. The result of the half-year was that they were able to pay their 4 per cent. dividend; to add £10,000 to the reserve fund, and to carry forward £14,607, which was £10,000 less than they brought into the account, and which really represented the effect that the competition of the motor-omnibuses had had upon them. In conclusion, the chairman explained that the company was promoting a Bill in Parliament empowering them to construct a second line from Shepherd's Bush to the depôt yard, which would enable them to run shorter trains when the traffic was light, and they also took powers to establish a superannuation fund for the employés. Before, however, anything was done in the latter matter, the details would have to be laid before the shareholders for their approval.

Lord St. Aldwyn seconded the motion, which, after a short discussion, was agreed to.

St. James' and Pall Mall Electric Light Co., Ltd.

The directors, in their report for 1906, state that the supply has been distributed from the Carnaby Street and Mason's Yard works on a total of 308,984 lamps, being an increase of 22,900 in the past 12 months. For this purpose 5,933,554 units were generated by the company, and 3,671,110 units were purchased from the Central Electric Supply Co. The cost of electricity purchased from the Central Co. has been largely reduced, and further economies are expected under the present conditions of working, which should provide for the payment of a dividend on the company's shares in the Central Co. in respect of the year 1907. Under these circumstances a sum of £1,000 has been transferred from the contingency fund to the net revenue account. The Bill promoted by the company last year, in association with other West-end companies, was set aside by the House of Commons, the whole question of bulk supply for the metropolis being dealt with by a Committee, appointed by that House, with special reference to a Bill promoted by the L.C.C. As a result of this Committee's report, a fresh Bill has been lodged by the L.C.C. for the ensuing session. The London Electric Supply Companies, on their part, are engaged in the promotion of a Bill, to enable them to associate together for the purpose of dealing with this question of bulk supply by means of their existing organisation, and of thus avoiding the immense capital outlay which any fresh scheme must involve. The directors regret that adverse conditions have continued to affect the business of the company during the year under review, and have caused a material reduction in the net revenue. The net profits for the year 1906 applicable to dividends on shares, including the sum of £1,000 transferred from the contingency fund to the net revenue account and balance brought forward, amount to £27,486 3s. 11d. The interim dividend paid in August last for the half-year ending June 30th, at the rate of 7 per cent. on preference shares and 10 per cent. on ordinary shares, amounted to £13,500, leaving an amount now to be dealt with of £13,986 3s. 11d. The directors propose a dividend at the rate of 7 per cent. on the preference shares for the second half-year, £3,500; a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid on August 1st last, a total distribution of 10 per cent. for the year, £10,000; and to carry forward £486 3s. 11d.

North Metropolitan Tramways.

The half-yearly meeting of this company was held on Wednesday at the Cannon Street Hotel, E.C., Mr. George Richardson presiding.

The Chairman, in moving the adoption of the report, said he had very little to say, for as they knew they were approaching the end of their existence. With regard to the return on the capital of the sum of £3 10s. per share, it would have been paid earlier, but since they had received the sanction of the court for the payment, certain formalities had had to be gone through, and they had had to verify the certificates, &c., but he could assure them that they had paid the money as soon as they could. They proposed to pay a dividend at the rate of 1s. per share. The company were still working a short length of line in the borough of East Ham, and he thought that they would still have it under their charge for some little time to come. All the company had to do now was to collect their assets. They would see from the report that the board considered the value of stock, horses, &c., in the County of Essex at £70,000, and they had lent the Metropolitan Electric Tramway Co. £277,000, that was being steadily repaid. Those sums, when collected, would be available for distribution to the shareholders, which would represent between £6 10s. and £5 per share. They had let their workshops and stables for some two or three years, and they were now simply landlords.

Mr. J. W. Greig seconded the motion, and the report was adopted.

Great Northern and City Railway Co.

The Earl of Lauderdale (Chairman) presided at the Westminster Palace Hotel, on Monday, over the seventeenth half-yearly meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 197), the Chairman said he was glad to be able to place before the meeting figures showing an increase in the traffic and a consequent increase in the earnings. The returns showed that the total number of passengers carried during the six months was 7,901,923, against 7,383,383 for the corresponding period, while the number for the entire year was 15,989,663, against 14,911,017 for 1905, which was an increase of 1,078,646, equal to 7·2 per cent. The number of local season tickets issued during the half-year was 3,013, against 2,663, and the total for the year was 6,144, against 5,576, an increase equal to 10·2 per cent. The number of three route season ticketholders was 2,313, against 2,292 for the half-year, and 5,010, against 4,839 for the entire year, equal to 3·5 per cent. increase. The traffic receipts were £45,564, against £42,933 for the half-year, and £92,134, against £86,419 for the whole year, an increase equal to 6·6 per cent. Gross receipts for the half-year were £48,367, against £45,711, and for the whole year £97,756, against £91,951, which was equal to an increase of 6·3 per cent. There were only four instances during the half-year when their trains were delayed for more than five minutes, notwithstanding that the train mileage had considerably increased. During the half-year the car-mileage was 1,075,825, which was an increase of 69,145, and they had also increased the train mileage by 48,200 over the same period, which was owing to a more frequent service and shorter trains. On week days during the busy times they had a 2½-minute service, consisting of 5 and 6-car trains, which had been found of great benefit to the public. During slack periods 2-car trains were run at intervals of 3½ minutes, and as the traffic developed, of course the service could be improved. The weather before the new year was not favourable to them, as there was an absence of fogs, and as the chairman of a Tube Railway he confessed that he regretted the absence of fogs. The chairman proceeded to deal with the statement of accounts for the half-year in a most exhaustive manner. Touching on Tables 4 and 5, which related to receipts and expenditure on capital account, he explained that £2,304,646 17s. 10d. had been expended on capital account, which was exclusive of £50,000 advanced for interest, and a sum not to exceed £35,000 for claims adjusted under agreements. These amounts were payable to the contractors in shares, and did not bear interest. In this account it would be noted that they had received £20,000 from the contractors under agreement, on taking over the working; £10,000 on revenue account, and a further

remission of interest of £1.240. Of the £51,188 expended on additional equipment during the half-year, £40 000 was payable by the Great Northern Railway. In No. 9 revenue account, the only noticeable item was that general charges were £1,139, against £914 which was explained in Table 12, by the fact that the directors' fees had increased from £625 to £850. This was owing to the contractors having nominated a member of the board, and to a re-arrangement of the chairman's remuneration. In No. 10 net revenue account, there were two fresh items. These were £2,230 interest, and stamp duty transferred from capital account, and £3,037 19s. 3d. interest payable to contractors. The latter item was the interest payable to the contractors in respect of the unpaid balance in connection with the extension equipment, and also the Parliamentary deposit loan. The interest worked out at £4,277, but the contractors had foregone £1,240, which, with the further £10,000 payable by them, cleared off the entire revenue debt. In the general balance sheet, it would be seen that the contractors account stood at £73,155. This is made up of interest due to the contractors prior to the opening of the lines, and the balance due for additional equipment, and of this, as he had already pointed out, £40,000 was payable by the Great Northern Railway. The amount due to engineers was £17,291, which was on account of their commission for the two stations and the extension to Finsbury Park, Of this £9,000 was payable by the Great Northern Railway. On the other side, £10,820 due to revenue account had been written off, and they started with a clear sheet as regarded debt owing to revenue.

Mr. C. Steel seconded the motion, which was carried without discussion.

An extraordinary meeting was subsequently held, when the action of the directors in bringing in a Bill in the ensuing session of Parliament was approved.

The Solicitor explained that the Bill was a simple one to extend the time limited for the completion of the railway for three years, and to enable 4 per cent. interest instead of 3 per cent. being paid on capital during construction.

Yorkshire Electric Power Co.

The report of the directors, to be submitted at the meeting to be held at Leeds on February 19th, states that the company is progressing steadily, and that substantial progress is being made in securing new customers. The units sold for the year 1906 amounted to 1,308,275 as against 335 966 for the year 1905. The demand from customers now connected to the mains amounts to 2,072 kw., as against 1,402 kw. on July 1st, 1906. Further agreements for 450 kw. have been signed up to December 31st last, and these customers are being connected up as rapidly as their own installations are ready. Negotiations are in hand with several other power users, and the directors anticipate that not only will the sales of energy for 1907 show a very decided increase on those of the previous year, but that the unit costs of production will be still further reduced. The company is now giving a bulk supply for lighting purposes in the U.D. of Gomersal, and is arranging for a similar supply in the U.D. of Horsforth, in connection with distributing orders acquired by Electrical Distribution of Yorkshire, Ltd. The removal of the central offices of the company to Thornhill has been found to work well, and with advantage both to efficiency and economy. As reported at the last half-yearly meeting of the company, the directors have resolved that for the present they will only charge against the amount which has been voted to them for fees, such a sum as will cover their travelling expenses to Leeds. Since the date of the last report, the company has to deplore the loss caused by the death of Mr. Arthur Currer Briggs, one of the promoters of the company, and a director whose services to the company have been of the greatest value from the outset of the undertaking.

Waterloo and City Railway Co.

The report of the directors for the half-year ending December 31st, 1906, to be submitted to the half-yearly meeting to be held on February 7th, says that the gross receipts of the line, less Government duty, amounted to the sum of £.6,727 and the working expenses to £7,527 during the past half-year, as compared with £17,464 and £7,859 respectively for the corresponding period of 1905. The balance available for dividend, after providing for interest on debenture stock, is £8,985, and a dividend at the rate of 3½ per cent. per annum on the ordinary stock will absorb £8,775, leaving a balance of £201. This dividend is at the same rate as for the corresponding period of 1905. The following table shows the number of passengers carried and other particulars for the last three half-years:—

Half-year ending	No. of passengers (exclusive of season ticket holders).	No. of season ticket holders.	Amount received (inclusive of season tickets, but less Government duty).	Working expenses. Amount charged.	Working expenses. Percentage of receipts.	Dividend on ordinary stock. Per cent.
Dec. 31, 1905	2,206,695	1,728	£17,071	£7,859	45 0	3¼
June 30, 19 6	2,181,068	1,978	17,039	7,815	45·0	3
Dec. 31, 1906	2,087,145	1,836	16,360	7,527	45·0	3¼

This railway was on January 1st, 1907, transferred to the London and South Western Railway Co., and, as from that date, the Waterloo and City Co. ceased to exist except for the purpose of dealing with the accounts for the past half-year and winding up its affairs.

Imperial Tramways Co., Ltd.

The directors' report to be submitted at the meeting to be held at Bristol, on Wednesday next, states that for the year ended December 31st, the gross receipts from the Middlesbrough, Stockton and Thornaby electric tramways amounted to £55,123, showing an increase of £3,736 over the receipts for the previous year. The number of passengers carried was 10,673,758, as compared with 9,935,876 last year, an increase of 737,882. After placing £3,400 to the reserve fund for renewals (bringing the total of that fund up to £13,400), the net profit for the year is £16,711. A Bill has been deposited to extend the time for constructing authorised extensions, and for other purposes. The company's holding in the London United Tramways (1901), Ltd., remains at 44,446 fully-paid 5 per cent. preference £10 shares, and the dividends received in respect thereof for the past year amount to £21,112. The company's net revenue account for the year shows an available balance of £41,617, and after payment of interest on the debenture stock for the whole year and interim dividends on the preference and ordinary shares in respect of the half- ear to June 30th last, amounting together to £26,125, it is proposed to appropriate the balance as follows:—Dividend at 6 per cent. per annum on the preference capital (paid on January 1st last), £5,700; final dividend at 10 per cent. per annum (making 9 per cent. for the year) on the ordinary capital (less income-tax), £9,500; and to carry forward to the next account, £291 11s. The reserve funds now amount to £126,271 14s.

Liverpool Overhead Railway Co.

The directors' report, to be presented at the half-yearly meeting on February 12th, shows that the gross revenue receipts amount to £39,321, and the working expenses to £30,191.

The number of passengers carried during the last two years is as follows:—

	Half-year ending June 30, 1905.	Half-year ending Dec. 31, 1905.	Half-year ending June 30, 1906.	Half-year ending Dec. 31, 1906.
First class	673,637	625,430	608,870	630,562
Third class (including tramways)	3,169,953	3,346,990	3,036,003	3,362,441
Workmen (special return tickets)	1,714,523	1,645,312	1,800,227	1,540,550
Total	5,558,113	5,617,672	5,445,100	5,533,553

The directors regret that the number of passengers carried shows a decrease of 84,119 as compared with the corresponding period last year, the receipts being £415 less. The value per railway passenger has been 1·80d. against 1·78d. There has been a reduction in expenditure of £1,996, and an increase of the net balance on the half-year's working of £1,637, which enables the directors to recommend the payment of the full year's dividend on all the preference shares.

Revenue Account.

Receipts from passenger traffic amount to	£38,842	17 6
Miscellaneous receipts and interest	978	9 7
	£39,321	7 1
Less working expenses and transfer to renewal funds	30,190	11 8
	£9,130	15 5
Deduct interest on mortgage debentures, and on calls paid in advance	4,329	8 2
	£4,801	7 3
Add balance brought forward, June 30th, 1906	3,796	16 3
Leaving available for dividend	£8,598	3 6

The directors recommend a dividend of 5 per cent. per annum on the (1892) preference shares, and the full year's dividend of 5 per cent. per annum on the (1900) preference shares (less income-tax), leaving a balance of £4,246 to be carried forward.

Train and Tram Mileage.

1905 half-year.		1906 half-year.
387,578	Passenger trains	434,387
142,770	Tramways	141,280

Kensington & Knightsbridge Electric Lighting Co., Ltd.

An extraordinary general meeting of this company has been convened to consider the draft of a Bill which the directors have considered it advisable to promote in Parliament, in conjunction with the whole of the other electrical supply companies in London, and the following are some of the principal provisions of the Bill:—

1. To authorise agreements between any of the companies for mutual assistance with respect to giving and taking a supply of electrical energy, and to provide generating stations, &c., in combination, including the establishment of a joint committee to control such stations if necessary for the purpose.

2. To empower any or all of the companies to amalgamate, subject to the sanction of the Board of Trade.

3. To modify the existing powers of purchase of the undertakings of the companies.

4. In consideration of the above, to impose an obligation upon all the companies to supply electrical energy for power purposes or to authorised undertakers at a price not exceeding four pounds per kilowatt per annum of maximum demand and one halfpenny per unit for all energy supplied.

The draft Bill has been prepared after careful and prolonged consultations between representatives of the whole of the London electrical supply companies.

Electric Supply Corporation, Ltd.

Mr. C. F. Tufnell presided on January 31st at an extraordinary general meeting, at which the following resolutions were carried:—

1. That the Bill proposed to be introduced into Parliament, entitled "A Bill for transferring to the Electric Supply Corporation, Ltd., certain undertakings authorised under the Electric Lighting Acts, 1882 and 1888, and for other purposes," be approved.
2. That the draft provisional order under the Private Legislation Procedure (Scotland) Act, 1899, for transferring to the Electric Supply Corporation, Ltd., certain undertakings authorised under the Electric Lighting Acts, 1882 and 1888, as amended by the Electric Lighting (Scotland) Act, 1890, and for other purposes, be approved; and
3. That the draft provisional order under the Private Legislation Procedure (Scotland) Act, 1899, providing for the transfer to a company to be formed under the name of the Dumbarton Burgh and County Tramways Co., Ltd., of the undertakings authorised by the Dumbarton Tramways Order, 1904, and the Dumbarton Tramways Order, 1906, and for other purposes, be approved.

According to the *Financial News*, the Chairman stated that the company's auditors had urged the advisability of the directors passing the resolutions, after consulting the Board of Trade and their own solicitor. As regards the third resolution, the new company would pay all the promoting expenses for obtaining the Order, and also the cost of the work involved by the Burgh Tramways. The new company had also agreed to take their supply from the Electric Supply Corporation, and it was hoped that the trams throughout the entire system would be running by the end of the year.

Anglo-American Telegraph Co., Ltd.

The directors' report, to be presented at the meeting to-day, shows that the total receipts from July 1st to December 31st, 1906, including the balance of £19,695 brought forward from the last account, amounted to £243,903. The traffic receipts show an increase of £11,986, as compared with the half-year ended December 31st, 1905. The working expenses of the half-year, as shown by the revenue account, amounted to £76,506, being an increase of £3,400 as compared with the corresponding period of 1905. Quarterly interim dividends of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, were paid on November 1st last, absorbing £52,500, and leaving a balance of £114,897, out of which the directors recommend the proprietors to declare final dividends of £1 12s. 6d. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 15s. per cent. on the deferred stock, payable on February 9th, amounting together to £113,750, making a total distribution for the year ended December 31st, 1906, of £3 17s. 6d. per cent. on the ordinary stock, £6 per cent. on the preferred stock, and £1 15s. per cent. on the deferred stock. The balance of £1,147 will be carried forward.

Smithfield Markets Electric Supply Co., Ltd.

The directors in their report for the year 1906 state that the gross profit amounted to £5,135 8s. 8d. and the net profit to £3,172 2s. 4d. The available balance including £1,409 11s. brought into the accounts is £4,581 13s. 4d., which the directors propose to carry to the general reserve fund. In view of certain matters the settlement of which has an important bearing on the future of the company, the directors are advised that it would be inexpedient to make any further distribution of profits at present. The price of energy was further reduced in the spring of last year, which has adversely affected the the gross revenue. A saving has been effected in the working expenses, but a large increase has occurred in the item of rates and taxes.

National Gas Engine Co., Ltd.—The directors' report for the year ending December 31st, 1906, says that the net profit for the year is £46,143. An interim dividend for the six months to June 30th, at the rate of 5½ per cent per annum on the preference shares and 20 per cent. per annum on the ordinary shares, was paid on July 31st, 1906, which amounted to £13,419. Deducting this from the year's profit leaves a balance of £32,725, to which must be added £5,068, brought forward from last year, making a total of £37,792 to be dealt with. The directors propose to pay a final dividend at the rate of 5½ per cent. per annum on the preference shares and 20 per cent. per annum on the ordinary shares, less income-tax, for the six months ending December 31st, 1906. This will absorb £17,118, and leave a balance of £20,675, out of which the directors propose to place £10,000 to the reserve fund (making it £70,000), and to carry forward £10,675.

British Aluminium Co., Ltd.—A meeting was convened for yesterday to consider a proposal to increase the capital to £1,300,000 by the creation of 40,000 6 per cent. "A" cumulative preference shares of £5 each and 40,000 1908 conversion shares of £10 each.

Metropolitan District Railway.—The directors recommend a dividend on the 4 per cent. guaranteed stock for the half-year at the rate of 1½ per cent. per annum. A year ago the dividend was at the rate of 1½ per cent. per annum.

Dublin and Lucan Railway Co.—After providing for debenture interest, the directors recommend the payment of the 5 per cent. preference dividend.

Buenos Ayres Grand National Tramways Co., Ltd.—The directors have resolved to pay an interim dividend of 2s. per share, less tax.

South London Electric Supply Corporation, Ltd.—The directors recommended a dividend on the ordinary shares of 3 per cent. for the past year.

Telegraph Construction and Maintenance Co.—Dividend of 10 per cent., in addition to the 5 per cent. already paid, making 15 per cent. for year 1906.

Dublin United Tramways Co., Ltd.—The directors' report shows that for the past half-year the amount available for division is £51,765, out of which it is recommended that a dividend be paid for the half-year at the rate of 6 per cent. per annum on the ordinary shares; £5,000 is to be placed to reserve and renewals fund, £1,000 to accident insurance fund, and £4,000 towards maintenance in the current half-year; £6,665 is to be carried forward.

At the annual meeting, held on the 5th inst., the chairman referred to the gratifying increase of £5,933 in gross receipts. The parcels traffic, which had lately been developed, was very successful, and was now an important source of revenue. The company had been urged, the chairman said, to extend this traffic further by running special cars, but this business, so far as street tramways were concerned, had its limitations if it was to be carried on at a profit. During the half-year the company had handled 874,317 parcels, from which the total profit was £3,117. In view of the greatly increased traffic expected in connection with the International Exhibition this year, the company had spent over £3,000 in improvements, and for this particular traffic 18 new top-covered cars would be available.

London Electric Supply Corporation, Ltd.—The accounts for the year ended December 31st, 1906, show a net revenue of £56,522 4s. 1d. £5,000 has been carried to reserve account. The directors propose to pay a dividend of 6 per cent. on the preference shares, and recommend the payment of a dividend of 4 per cent. upon the ordinary shares for the year 1906, and to carry forward the sum of £4,170. Last year the dividend was at the same rate, but £25,000 was placed to reserve, and £3,142 carried forward.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Buenos Ayres Grand National Tramways Co., Ltd.—90,000 five per cent. cumulative preference shares of £5 each, fully paid, Nos. 1 to 90,000; and 113,436 ordinary shares of £5 each, fully paid, Nos. 1 to 113,436.

De Mello Brazilian Rubber Co., Ltd.—175,000 seven per cent. participating cumulative preference shares of £1 each, fully paid.

City of Buenos Ayres Tramways Co., Ltd.—The directors recommend a balance dividend of 1s. 3d. per share for the year 1906 and the transfer of £3,500 to the general amortisation fund, carrying forward £134.

Charing Cross, West End and City Electricity Supply Co., Ltd.—An extraordinary general meeting of this company was to be held yesterday to pass a resolution approving the Bill proposed to be introduced into Parliament, entitled "A Bill to make further provisions with respect to the supply of electrical energy in London and surrounding districts, and for other purposes," subject to such additions, alterations and variations as Parliament may think fit to make therein.

National Telephone Co., Ltd.—The directors have resolved, subject to final audit, to recommend the following dividends for the half-year ending December 31st last, after payment of the dividends on the preference shares:—At the rate of 6 per cent. per annum on the preferred stock, at the rate of 5½ per cent. per annum on the deferred stock, less income-tax, carrying £135,000 to reserve and about £10,000 forward. The transfer books will be closed from the 8th to the 21st inst. inclusive, and dividend warrants will be deposited on the latter date. Last year the dividend on the deferred stock was only 5 per cent. for the corresponding period, £125,000 was placed to reserve, and £9,859 was carried forward.

Lanarkshire Tramways Co.—The report for the half-year ended December 31st last, shows that the directors recommend a dividend at the rate of 5½ per cent. per annum on the 24,423 shares issued prior to January 1st, 1906, carrying forward £882. The extension line to Cambuslang was completed and opened for public traffic on January 20th. Capital expenditure during the half-year has amounted to £40,671, which has been expended mainly on the Cambuslang extension and six new cars.

Central Electric Supply Co.—The report for the year ended December 31st, 1906, states that energy has been supplied to the St. James's and Pall Mall Electric Light Co., Ltd. and the Westminster Electric Supply Corporation, Ltd., throughout the year to the amount of 11,329,960 units. After making a full allowance for sinking fund and depreciation and taking into account the amount brought forward from 1905, the balance of net revenue account to be carried forward is £6.—*Financial Times.*

Prospectuses.—*Kalgoorlie Electric Power and Lighting Corporation* (1906), *Ltd.*—Authorised capital, £225,000. Issue of £60,000 6 per cent. first mortgage debentures, in debentures of £100 and £50 each.

Mawdsleys, Ltd., Dursley, has been registered with £20,000 capital, to take over the business of electrical engineers carried on by R. A. Lister & Co., Ltd.

American Telephone and Telegraph Co.—Issue of $40,000,000 4 per cent. convertible gold bonds of $1,000 each, being part of an issue limited to $150,000,000.

MARKET QUOTATIONS.

Wednesday, February 6th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	32/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal)	per ton	£33 10	..
a ,, ,,	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£15	..
a Copper Sulphate	per ton	£32 10	..
a Lead, Nitrate	per ton	£34 10	..
a ,, White Sugar	per ton	£35	..
a ,, Peroxide	per ton	£32	..
a Methylated Spirit	per gal.	2/6	..
a Naphtha, Solvent (90 % at 160° C)	per gal.	5/6	..
a Potassium Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7½d.	..
a Shellac	per cwt.	230/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %	per ton	£10 15	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide (basis 100 %)	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£200	..
b ,, Wire, in ton lots	per ton	£220	..
b ,, Sheet, in ton lots	per ton	£210	..
p Babbitt's metal ingots	per ton	£61 to £203	..
c Brass (rolled metal 2" to 12") basis	per lb.	11¼d.	¼d. inc.
c ,, Tube (brazed)	per lb.	1/0½	¼d. inc.
c ,, ,, (solid drawn)	per lb.	11⅜d.	¼d. inc.
c ,, Wire, basis	per lb.	11½d.	¼d. inc.
c Copper Tubes (brazed)	per lb.	1/2½	¼d. inc.
c ,, ,, (solid drawn)	per lb.	1/2⅝	¼d. inc.
g Copper Bars (best selected)	per ton	£124	..
g Copper Sheet	per ton	£124	..
g ,, Rod	per ton	£124	..
e ,, (Electrolytic) Bars	per ton	£117	£2 inc.
e ,, ,, Sheets	per ton	£126	£1 dec.
e ,, ,, Rod	per ton	£124	£7 inc.
e ,, ,, H.C. Wire	per lb.	1/2¼	¼d. inc.
f Ebonite Rod	per lb.	8/8	..
f ,, Sheet	per lb.	8/-	..
n German Silver Wire	per lb.	1/9	..
h Gutta-percha, fine	per lb.	6/- to 7/-	..
h India-rubber, Para fine	per lb.	5/1	..
i Iron, Charcoal Sheets	per ton	£18	..
i ,, Pig (Cleveland warrants)	per ton	57/1	2/6½ dec.
i ,, Forgings, according to size	per ton	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	..
i ,, Wire, galvanised No. 8	per ton	£9 15	..
g Lead, English Ingot	per ton	£19 17 6 to £20	5/- dec.
g ,, ,, Sheet	per ton	£21 7 6 to £21 10	5/- dec.
m Manganin Wire No. 28	per lb.	8/	..
g Mercury	per bot.	£7	..
d Mica (in original cases) small	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/4½ to 1/6½	..
p ,, rolled bars & rods	per lb.	1/5½ to 1/6½	..
p ,, ,, strip & sheet	per lb.	1/6 to 1/10	..
o Platinum	per oz.	150/-	..
e Silicium Bronze Wire	per lb.	1/3½	½d. inc.
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
,, ,, in bars		£15 to £40	..
g Tin, Block (English)	per ton	£195 to £196	50/- inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals—			
"White Ant" brand	per ton	£61 to £85	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£30 15	£1 dec.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Power Gas Corporation, Ltd.—The report for the year ended September 30th last states that the year's trading of Messrs. Ashmore, Benson, Pease & Co., Ltd., shows a profit of £1,581, as compared with a loss of £1,483 on the former year's trading. Messrs. Ashmore, Benson, Pease & Co., Ltd., are the only debenture-holders and the principal shareholders in the A.B.P. Accumulator Co., Ltd., whose business formed a department of the Stockton Works when they were originally taken over by the Corporation. It having been found impossible in spite of prolonged efforts to make this business a profitable one, it has now been decided to liquidate the concern voluntarily to avoid further losses.

STOCKS AND SHARES.

Tuesday Evening.

We were gravely told to-day by a shrewd and experienced member of the Stock Exchange, that the cause of the depression round the markets was—the weather! He maintained in all seriousness that the nip of the frost, and the snow and the wind, was the ultimate cause of that lack of business which the City deplores.

This we mention as showing what the Stock Exchange is reduced to in the way of explaining the dullness in prices and the dearth of orders.

Weather or no, markets are dull enough, in all conscience. It is a pleasure to record a rise of 2 points, to 45 *ex* dividend, in City and South London: there are so few improvements amongst Home Railway stocks generally. Central London Deferred, carrying its full 4 per cent. dividend, is down a point, and so is the Preferred stock. Underground Electric 5 per cent. Notes have steadied after their slump, and the price, at 83, shows a rebound of 2. Metropolitan sprinted to 50, *ex* its 5s. dividend, but fell back, exhausted by such strenuous effort, to 48, and Districts are 17.

Another stock which has risen is British Columbia Electric Preferred Ordinary, the advance being 3 per cent., to 115. The company has issued a private and confidential circular to its stockholders, asking them to intimate whether they would desire to do any underwriting in the new issue which may be offered shortly. It is a singular request, but the company says that the issue might be made in a hurry. Of course, proprietors should reply in the affirmative, because they commit themselves to nothing, and the underwriting of a new debenture issue might turn out profitably in the future.

Reaction after their recent fall has made British Electric Tractions, of both kinds, 7s. 6d. a share harder, though the First Debenture stock fell somewhat. Calcutta Trams drooped, though the traffics are good, all things considered. The Anglo-Argentine group has improved to a slight extent. Belgrano Ordinary continue the popular favourite, scoring a further 2s. 6d. rise. Auckland Debenture at 105½ has hardened. Of the home varieties, London United Preference are 10s. lower at 8½, while Metropolitan Tramways Preference are not only *ex* 6d. dividend, but show ⅓ rise as well at 18s. 9d. A good deal of business is being done in the tramway market. By the way, some misguided soul paid 15s. 7½d. for London United Omnibus (Vanguard) Ordinary shares the other day.

Electricity Supply shares are dullish. Westminsters certainly exhibit 10s. rise to 10, the dividend declaration being rather better than anticipated. It makes 12 per cent. for the year, against 13 per cent. for 1905, and 14 per cent. in the preceding twelvemonth. Another dividend lately announced is 4 per cent. on London Electric Ordinary, but this produced no change in the price of the shares; it is the same as that of a year ago. The St. James's report is a poor affair, but the fall took place in advance of the figures. Edmundsons are lower, and Urban Preference declined with them. Metropolitan Electric Ordinary at 7½—still 50 per cent. premium—are 10s. lower, and a few Debenture stocks are down, some of the falls being accounted for by *ex* dividend markings. Folkestone Preference rose to 5¼ upon a little demand from the country; perhaps the Kent Collieries will be able to help the existing electric lighting companies instead of competing with them, when Kent coal becomes a commercial instead of a humorous matter.

Ascending to Telegraphs, the market, on the whole, is a firm one. Globe Ordinary at 10⅝ are 4s 6d. better, and the Preference at 14½ have recovered the 3s. dividend. This gives a key to the market as a whole. A drop in Anglo-American Deferred is linked to the slump in American Rails, while operators for the rise have taken advantage of the unexpectedly good dividend announcement to secure profits. Eastern Extension shares at 13¾ are up, though Eastern stock remains unchanged. Other descriptions are steady, without much quotable alteration.

National Telephone Deferred sticks at 111½ after rising ½ to 112 upon the dividend at the rate of 5½ per cent., making 5½ for the whole year, and the 3½ per cent. Debenture stock advanced a point. The achievement is certainly a good one, but to buy the Deferred stock now, so close to the time when the company will become literally National, is a speculative proposition. United River Plate Telephones eased off to 7, and stand level with the price of Chili Telephone shares.

The heavy issue of new shares by the British Aluminium Co. has produced no alteration in the prices of existing shares. One of the features amongst the Industrial list is the rise in Brush Ordinary and Preference, to 4½ and 1⅝ respectively. Willans and Robinsons are without change. Dick, Kerr Preference are a shade off, and Telegraph Constructions 10s. better upon the dividend of 10 per cent., making 15 per cent. for the year.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations Jan. 29th.	Closing Quotations Feb. 5th.	Business done week ended Feb. 5th, 1907. Highest.	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149 600	Do. do. 5 % Debs., Nos. 1 to 1,200 Red.	100	Nil	Nil	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	6½.	2¾%	3½%	3¾%	68½ — 70½	68½ — 70½	..	..	..	5 9 11
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5½%	6 %	6 %	112 — 113	112 — 113	112⅝	1 2 ..	..	5 6 2
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	⅛%	1¾%	27⅜ — 27¾	26⅞ — 27⅛	27 1/16	26½	— ⅛	6 8 5
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	101 —103	101 —103	..	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6¾ — 7¼	6¾ — 7¼	..	..	..	5 10 4
2,097,680	Commercial Cable Bldg. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	96½ — 98½	96¾ — 98½	97⅛	96⅛	..	4 1 3
16,000	Cuba Telegraph	10	0 %	5 %	5 %	..	8½ — 9	8½ — 9	..	..	..	5 11 1
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	..	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8⅜ — 8⅝	8⅜ — 8⅝	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	9 — 9½	9 — 9½	..	..	..	5 5 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	8 %	8½%	4½%	..	15½ — 16 xd	15½ — 16	15⅛	..	..	5 6 3
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,300,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 —142	137 —142	140½	138½	..	4 18 7
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	..	86 — 88	86 — 88	87	86⅜	..	3 19 7
1,896,766	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	105¾ —107½	106 —108	..	..	+ ½	3 14 1
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½ — 13¾	13½ — 14	13⅜	13 7/16	+ 1/16	5 0 0
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	106¾ —108½	105 —107 xd	106½	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	101 —103	99 —101 xd	..	..	..	3 19 3
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	101⅜	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10½ — 10⅝	10⅜ — 10⅞ xd	10⅜	10⅜	..	5 2 4
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	14 — 14½	14 — 14½ xd	14⅜	14⅜	..	4 2 9
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	14 %	24%	..	37½ — 39½	37½ — 39½	..	..	..	6 6 6
83,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	..	58 — 60	58 — 60	..	..	..	5 8 4
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅞ — 1	⅞ — 1	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	4 %	5 %	..	1 — 1⅛	1 — 1⅛	..	..	..	4 8 11
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	1 5/16 — 1 7/16	1 3/16 — 1 7/16	..	..	..	4 16 5
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	109 —111	109 —111	109½	109½	..	5 8 1
2,225,000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½%	110½ —112½	110½ —112½	112⅜	111	..	4 17 9
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11 — 13	11 — 13	12⅜	..	..	4 12 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	11⅜	..	..	5 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5½ — 6⅛	5⅝ — 5⅞	5⅞	5 7/16	+ 1/16	4 5 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	96 — 98	97 — 99	97⅜	97⅛	+1	3 10 8
1,689,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	102	..	..	3 18 5
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6¼%	6¼%	7½%	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	4 11 5
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	26 — 29	26½ — 28½	..	..	..	4 1 3
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½ —101½	100 —102	..	..	+1	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	..	7½ — 8	7½ — 8	..	..	..	5 0 0
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
8,167	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	126 —129	126 —129	..	..	..	4 13 0
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅞ — 7⅛	6⅞ — 7⅛	..	..	— ⅛	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5 1/16	..	..	4 11 11
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	108 —111	109 —112	..	..	+1	4 9 3
15,600	West African Telegraph, Shares	10	4 %	4½%	4 %	..	10 — 10½	10 — 10½	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13¾ — 14½	13⅞ — 14½	14⅛	13 13/16	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	99 —102	101 —104	..	..	+2	3 16 11
88,891	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref. ..	10	7 %*	6 %	5 %	..	7 — 7⅜	7 — 7⅜	7¼	7 1/16	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	5⅝ — 6¼	5⅝ — 6¼	..	..	..	Nil
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	99—102	99—102	..	..	..	4 18 0

Including arrears.

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	5	..	8 %	8 %	..	7⅞ — 8⅛	7⅞ — 8⅛	8 1/16	7 15/16	..	4 18 6
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5¼%	5½%	5 11/16 — 5 13/16	5⅝ — 6	5 13/16	5⅞	+ 1/16	4 11 8
268,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	186 —189	185 —188	..	..	—1	4 6 11
985,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	103 —106	104 —107	105	..	+1	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	30 %	30 %	..	3½ — 4⅛	3¾ — 4⅛	81/10⅛	80/3	..	4 14 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	6 — 6¼	6 — 6¼	6⅛	6 1/16	..	5 12 0
40,000	Do. do. 7 % Cum. Pref...	5	Nil	7 %	7 %	..	6¼ — 6⅜	6¼ — 6⅜	..	..	..	5 3 8
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5 — 5⅛ xd	5 — 5⅛ xd	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4¼	4 — 4¼	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	101 —105	..	..	..	4 15 3
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	100 —103	98 —101 xd	..	..	..	5 8 11
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	..	130 —135	130 —135	..	..	..	4 8 11
900,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	110 —114	113 —117	116	..	+ 3	4 5 6
300,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	105 —110	105 —110	109½	..	..	4 10 11
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —105	102 —105	102½	..	..	4 5 9
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,301	British Electric Traction	10	6 %	6 %	3 %	..	3⅝ — 4⅜	3⅝ — 4⅛	73/9	65/-	+ 3/8	7 2 0
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	7½ — 7⅞	7⅞ — 8⅛	7 15/16	7 7/16	+ 1/16	7 5 11
1,448,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	107 —110	106 —109	108½	..	—1	4 11 9
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	85 — 88	85 — 88	85	..	..	5 2 3
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	..	6¾ — 7	6¾ — 7	..	..	..	5 14 3
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6⅝ — 6¾	6¾ — 6 xd	..	..	..	5 0 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	94 — 98	94 — 98	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1⅜ — 1⅝	1⅜ — 1⅝	25/-	24/6	— ⅛	Nil
1,015,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	71 — 75	70 — 74	..	..	—1	5 8 1
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅝ — ¾	⅝ — ¾	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref. ..	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,781	Brush Electrical Engineering, Ord., 1 to 105,781 ..	1	Nil	Nil	20%	..	¾ — 1	¾ — 1 1/16	18/9	..	+ 1/16	4 15 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1⅝ — 1¾	1¾ — 2	32/6	32/1½	+ ⅛	6 0 0
195,000	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	95 — 97	95 — 97	..	..	..	4 12 9
125,000	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	..	3½ — 4	3⅝ — 4⅛	82/6	75/-	+ 3/8	3 12 9
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	..	..	5 11 8
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	..	5 — 5⅛	5 — 5⅛	5⅛	..	..	5 14 3
13,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	102⅜	..	..	4 16 2
105,000	Calcutta Trams., 1 to 105,000	5	6 %	8 %	8 %	..	8¼ — 8⅝	8 — 8¼	8⅛	..	— ⅛	4 14 1
82,610	Do. 105,001 to 187,610	5	..	..	8 %	..	7⅞ — 8⅛	7⅞ — 8¼	7⅞	..	— ⅛	4 17 0
30,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5¼ — 5⅜	5¼ — 5⅜	..	..	..	4 6 11
850,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	108 —106	108 —106	..	..	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	..	9¾ — 10¼	9¾ — 10¼	..	..	..	7 3 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5¼ — 5⅜	5¼ — 5⅜	..	..	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
491,229	Cape E. Trams., 1 to 491,229	1	10 %	5 %	Nil	..	1/16 — 1/8	1/16 — 1/8	10/6	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	5 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 1 1
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102 xd	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock ..	Stock	4 %	4 %	4 %	4 %	79 — 81	78 — 80	80	78½	—1	5 0 0
544,216	Do. do. 4 % Pref. Stock ..	Stock	4 %	4 %	4 %	4 %	97 — 99	96 — 98	97	96	—1	4 1 3
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	70 — 73	68 — 71	70	..	—2	5 12 8
1,480,000	City and South London Railway	Stock	2¾%	2¾%	1¾%	2¾%	43 — 45	44 — 46 xd	45	44	+1	4 12 4
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1 15/16 — 2 1/16	1⅞ — 2⅛	41/8	40/-	..	3 10 2
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 998 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	94 — 97	94 — 97	97	..	..	5 3 1

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(continued).

Present Issue.	NAME,	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 29th.	Closing Quotations Feb. 5th.	Business done week ended Feb. 5th, 1907.		Rise + or Fall—	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest.	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1 7/8 — 1 11/16	1 7/8 — 1 11/16	21/9	..	..	5 18 6
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	— 1/16	5 1 1
294,150	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	5½ %	6 %	6 %	..	14 — 15	14 — 15	..	..	..	4 0 0
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	14 — 15	14 — 15	..	..	..	4 0 0
99,261	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,261	5	Nil	2½ %	4½ %	..	1 3/8 — 1 5/8	1 3/8 — 1 5/8	..	..	..	8 6 9
17,189	Do. "A" shares, 01—017,189	5	Nil	2½ %	4½ %	..	2 1/4 — 2 3/8	2 1/4 — 2 3/8	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	90 — 95	90 — 95	91	90¾	..	5 5 3
112,100	Electric Construction 1 to 112,100	1	4 %	Nil	Nil	..	1/2 — 7/8	1/2 — 7/8	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	1	7 %	7 %	7 %	..	1½ — 2	1½ — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84 xd	81 — 84	..	..	..	4 15 3
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	1 7/8 — 1 3/4	8 7/8 — 1 3/4	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	8½ — 8¾	8½ — 8¾ xd	67/6	..	..	11 18 9
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —104	..	..	+ ½	4 16 2
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	..	11¾ — 12¼	11¾ — 12¼	..	..	..	6 8 0
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5 5/16 — 5 3/8	5 5/16 — 5 3/8	..	..	..	4 0 11
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 2 7
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10%	5 %	10%	10 %	15¾ — 16¼	15¾ — 16¼	16	..	..	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1½%	Nil	Nil	1½ — 1½	1½ — 1½	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 2 10
600,070	London United Trams (1901), 1 to 50,007	10	8 %	6 %	8 %	..	7 — 8	7 — 8	..	..	..	5 2 2
399,930	Do. do. 60,008 to 100,000 (£8 paid)	10	8 %	6 %	8 %	..	3 — 3¼	5 — 5½	..	..	..	5 11 1
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	8½ — 9¼	8 — 9	8⅝	..	— ⅛	4 7 11
1,881,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	88 — 91	89 — 91	..	..	+ ½	Nil
814,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	..	3/32 — 3/32	3/32 — 3/32	3/3	3/-	..	5 0 0
600,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	3/32 — 3/32	1/8 — 1 xd	18/9	18/6	..	4 10 11
850,000	Do. 4½ % Deb. Stock Red.	100	..	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 8
30,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4 1/16 — 4 1/8	4 1/16 — 4 1/8	..	..	..	5 14 4
24,500	Potteries E. Tro., 20,001 to 40,000 & 50,001 to 54,500	10	5 %	5 %	4 %	..	6 — 7	6 — 7	..	..	..	5 0 0
24,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	5 %	5 %	5 %	..	7 — 8	7 — 8	..	..	..	4 8 8
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	98¼ —101½	98¾ —101½	..	..	..	4 8 7
87,850	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	30 — 32	31 — 33	32	31⅞	+1	3 17 8
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	Nil
8,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	5 %	5 %	5 %	80 — 82	82 — 84	..	..	+2	5 19 1
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	3 %	Nil	Nil	..	1¾ — 2	1¾ — 2	32/6	..	..	Nil
66,666	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3¾ — 4	3¾ — 4	..	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	77 — 82	77 — 82	77	..	..	4 17 7

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5⅛%	5⅛%	..	5 — 5⅛	5 — 5⅛	..	..	..	5 0 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 11 1
10:.02	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7⅛ — 8	7⅛ — 8	..	..	..	4 7 6
336,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	8 %	8 %	5 %	..	3½ — 4¼	3½ — 4¼	73/9	..	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	3¾ — 4	3¾ — 4	..	..	..	5 12 6
427,400	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —102	98 —101	..	..	—1	3 19 3
49,436	Chelsea Electricity Supply, Ord.	5	5½%	6 %	6 %	6 %	5 — 5⅛	5 — 5½	..	..	..	5 9 1
176,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	106½	106	..	4 4 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	6 %	6 %	..	9¾ — 10¼	9¾ — 10¼	10⅞	..	..	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	11¼ — 12¼	11¼ — 12¼	..	..	..	4 18 6
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
40,000	County of Durham Electrical Power, Ord.	4	4 %	£3 7 0	4 %	..	3 15/16 — 4 1/16	3 15/16 — 4 1/16	..	..	..	3 16 2
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	4 3/8 — 4 5/8	4 3/8 — 4 5/8	..	..	..	4 15 3
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	..	8¼ — 9¼	8¼ — 9¼	8 11/16	8 3/32	..	5 8 1
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10¾ — 11⅛	10¾ — 11⅛	..	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108	105 —108	108	..	..	4 3 4
400,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	4 %	..	2¼ — 2⅜	2 — 2¼	40/-	..	— ⅛	8 0 0
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	4 — 4¼	4 — 4¼	81/3	..	..	6 13 4
350,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	4½%	93 — 97	93 — 96	..	..	— ½	4 13 9
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 17 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	..	5 — 5⅛	5 — 5⅛	..	..	+ ⅛	4 10 11
90,000	Do. 4½ % 1st. Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	97 —100 xd	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	9 %	..	7⅛ — 8	7⅛ — 8	..	..	..	5 12 6
21,000	Kensington and Knightsbridge Electric Ord.	5	12%	12 %	10 %	..	9¾ — 10¼	9¾ — 10¼	..	..	..	4 17 7
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	99 —102	97 —100 xd	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	2 — 2⅛	2 — 2⅛	..	..	..	4 17 0
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 4½	4⅜ — 4½	..	..	..	3 14 3
874,896	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4¼%	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½%	10 %	10 %	10 %	7⅜ — 8⅛	7 — 8	7⅜	7⅛	— ⅛	6 5 0
75,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	5⅝ — 5⅞	5⅛ — 5⅜	..	..	..	4 3 9
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —110	106 —110	..	..	..	4 1 10
250,000‡	Do. 3¾ % Mort. Deben. Stock Redem.	Stock	3¾%	3¾%	3¾%	3¾%	94 — 96	93 — 95	..	..	—1	3 13 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 —100	96 — 99	98	..	—1	4 10 11
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	..	7⅞ — 8	7⅞ — 8	..	..	..	5 0 0
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	..	5⅝ — 5¾	5⅝ — 6⅛	..	..	..	4 1 8
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½%	..	13 — 14	13 — 14	..	..	..	5 7 2
64,000	Do. do. 4 % 1st Mort. Deb.	100	4 %	4 %	4 %	..	97 —100	97 —100	..	..	..	4 0 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6⅛%	7 %	7 %	..	6 — 6⅛	6 — 6⅛	..	..	..	5 7 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	12½%	10 %	9 — 10	9 — 10	..	..	..	5 7 0
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
150,000‡	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	94 — 96	93 — 95	..	..	—1	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	..	1¾ — 2⅛	1¾ — 2⅛	..	..	..	8 0 0
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	73 — 77	71 — 75 xd	..	..	..	5 6 8
55,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	..	2⅝ — 3⅛	2⅝ — 3⅛	..	..	..	5 18 6
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2⅜	..	1⅜ — 1⅝	1⅜ — 1⅝	14/4½	..	..	3 6 8
117,968	Do. Do. 7 % Pref.	1	7 %	7 %	7 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
60,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	6 13 4
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4 — 4½	3¾ — 4¼	..	..	— ⅛	5 17 8
230,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½%	4½%	..	99 —102	99 —102	..	..	..	4 8 3
110,000	Westminster Electric Supply, Ord.	5	18⅜%	14 %	18 %	12 %	9 — 10	9⅛ — 10⅛	10⅛	..	+ ⅛	5 19 0
81,279	Do do. 4½ % Cum. Pref. (Originally 5%— Red. to 4½ % from 31st Dec., 1905.	5	5 %	5 %	5 %	4½%	5¼ — 5⅜	5⅛ — 5⅜	..	..	..	3 18 3

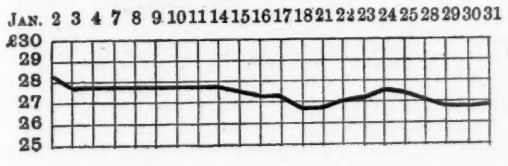
Shares not officially quoted:—Mackay Companies, ord., 74—76. Pref. 71—73.
† Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 5 per cent. January 17th, 1907.

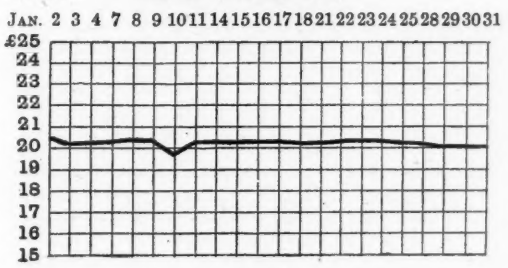
METAL MARKET.

Fluctuations in January, 1907.

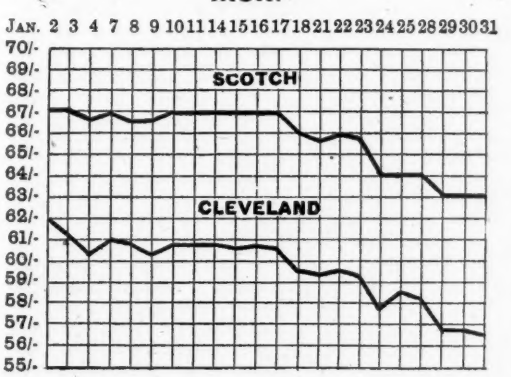
SPELTER (G.O.B's.)



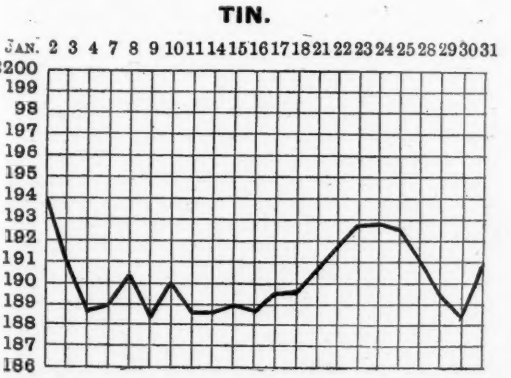
LEAD (ENGLISH)



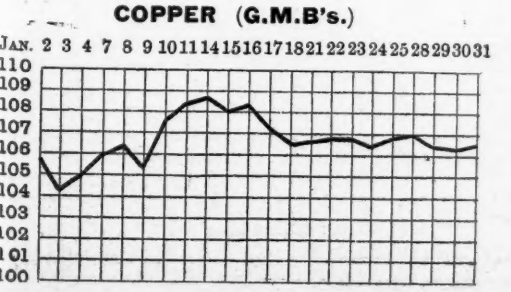
IRON.



TIN.



COPPER (G.M.B's.)



THE AMERICAN CO-OPERATIVE ELECTRICAL DEVELOPMENT ASSOCIATION.

By R. BORLASE MATTHEWS, Wh. Ex., A.M.I.C.E.

From time to time reference has been made in the columns of the Electrical Review to the Co-operative Electrical Development Association, which is doing so much in the United States for the furtherance of the employment of electricity as an every-day factor in facilitating industrial operations, and in adding to the comforts and conveniences of domestic life. The work of this Association has now become such a proved success that it has been decided to incorporate it in accordance with American laws.

The inception of this Association took place barely two years ago, when some of the incandescent electric lamp manufacturers of the United States considered a scheme for increasing their business by educating the general public as to the advantages of electricity as a means of illumination, the increased adoption of electric light, of course, resulting in a corresponding increase of lamp sales. Any one lamp company could carry out such a scheme to a certain degree, but the expenditure would be considerable, and it would be difficult to ensure that the resulting orders for lamps should be placed with them, for an educational campaign of this nature would undoubtedly also benefit their competitors to a great extent. This fact might have led to the abandonment of the idea were it not that the lamp manufacturers were wise enough to make an arrangement to work together in the broad scheme, so that all might be able to partake in the advantages of largely increased sales, while at the same time the number of orders received by each company would still depend upon the quality of the lamps supplied and the individual activity of each concern. As a result of this co-operation, a committee was appointed in May, 1905, under the chairmanship of Mr. J. R. Crouse, to consider the practical working of the details of the scheme, a sum of £2,000 being voted to cover the preliminary expenses of its inauguration.

This committee, in the course of its work, came to the conclusion that if an educational campaign were properly carried out, not only would the lamp manufacturers benefit, but also the whole electrical industry and all those connected with it, and that tremendous possibilities unfolded themselves, needing only the requisite capital and intelligent management to develop them along thoroughly successful lines. Accordingly the plans of the committee were laid before a representative body of manufacturers of electrical supplies and apparatus, and also the delegates of the various Electrical Associations of central station managers and contractors, with the outcome of the formation of the Co-operative Electrical Development Association.

The purposes for which the Association was formed are defined as being the promotion of the increased and more wide-spread use of electric current by the public for light, heat and power, both as an end in itself, and as a means of developing an increased demand for apparatus and supplies; the co-operative planning and execution of the various means and methods effective to this end; the establishment of co-operative relations, both moral and financial, among the different electrical interests, from the manufacturer to the consumer, to the end that each may contribute in some measure toward bringing about the above-mentioned results desired in common by all, and the mutual co-operation, benefit and protection of its members. The Association was not formed to make a profit or to make or declare dividends, and is not to engage directly in the business of selling electrical energy or manufacturing or selling electrical machinery, apparatus or supplies of any kind.

In a recent number of the *Western Electrician* an extract is given from the report of the working of this Association up to the period of its incorporation, which shows that up to November 30th, 1906, the sum of £5,650 had been expended in promoting the objects of the Association, and liabilities to the extent of £2,000 had been incurred for work in progress. It is difficult, of course, fully to trace the results of the efforts of such an Association, as a great deal of its work must necessarily be such as to bring about these results indirectly;

however, as a direct outcome of its operations 165 central stations in the United States have inaugurated show rooms, and a total amount of £110,000 has been expended by the various electric light companies in advertising and canvassing for new business—results which indicate what valuable work this Association is doing. A moderate estimate puts the number of the added 8-c.p. equivalent lamp connections at nearly 6,000,000, or, in other words, apparatus having a total demand of 180,000 kw., representing also a capital expenditure of approximately £4,200,000 for the necessary generating and distributing plant required to supply these additional connections. This expenditure alone would fully justify the disbursement of £7,000 by the Association. So great has this success been, that the campaign outlined for 1907 is to involve the expenditure of about £32,000.

The financial basis of the Association is an appropriation or contribution by the electrical manufacturers, contractors, supply houses and central stations of one-tenth of 1 per cent. on their sales, a tax which can be in no wise considered a material burden to those who co-operate in the movement; but while it is small in the case of any individual company, it is readily seen that it makes a very large sum in the aggregate, and will render possible the prosecution of extensive plans for increasing the business. The results attained thus far have established the soundness of the general principles of the plans, and the decision to extend them shows that the growth of the electrical business can, by this means, be continuously developed and increased.

At this juncture it will, doubtless, be of interest to refer to the methods adopted by the Co-operative Electrical Development Association in bringing about the ends desired. It is assumed that the field in which electricity can be employed can be comprised in two sections, namely, that part covered by the supply from central stations, and that served by private generating plants. The former is much the easier to reach, and deals with a larger section of the general public, and consequently it was selected by the Association for the commencement of the campaign, which, in the first place, was directed at the management of the central stations, with a view of educating them up to the fact that it was to their interests to inaugurate an active campaign for themselves in their own territories. This was done by arranging for the compilation and subsequent distribution by post of a series of publications at fortnightly intervals, dealing with the successful methods of canvassing and advertising that had been adopted with profit by other central stations, and which it would be well for them carefully to consider with a view of adaptation to their own circumstances. This was followed up by getting the travellers of the various manufacturing companies to refer to the work of the Association when calling upon a central station manager, and to ask him for particulars of any special methods that he was employing to increase his business.

The Association also arranges that papers on the commercial development of electrical undertakings shall be read at the meetings of societies and institutions connected with central station interests.

In 1906 prizes of £100, £60 and £40 were offered for the best papers written by central station managers or their assistants, on the organisation of commercial sales departments for central stations in cities having populations of under 50,000 inhabitants. The papers of the prize winners were printed and copies sent to every central station. For 1907 a more elaborate prize scheme has been announced, the subject of competition being a canvasser's handbook, divided into sections for power, lighting and heating. The first prize for each of the first two sections amounts to £100, and for the third, £60, the prize list totalling the sum of £520, a figure which is sure to attract the attention of central station managers and their staffs; even if they do not all compete, it will set them thinking seriously about the matter, as to what they can do in the way of assisting their canvassers to become more efficient, and when the prize handbooks are published, it will ensure a very careful reading for them.

The assistance of the electrical Press has been obtained, with the result that space is devoted regularly to articles and notes concerning the extension of the electrical supply industry along modern commercial lines.

A scheme is in course of development for the formation of an Electrical Press Bureau, whose duties will consist in supplying the newspapers and other publications with authentic news and information concerning matters electrical, designed to make electricity a familiar topic, and to remove the many groundless fears that exist as to the dangers supposed to accompany its use.

The plans of the Association are also developing rapidly in many other directions.

In the issue of the *Western Electrician* dated January 5th, 1907, an extract is given from the report of a discussion by representatives of the Joint Electrical Trades upon the work of the Association. Central station managers seem to be the most enthusiastic in their laudatory comments on the assistance the Association has rendered them, though all branches of the industry have felt good results from the movement. It is especially interesting to note that in the course of the discussion it was declared that one or two of the large electrical manufacturing companies were not anxious to broaden the scope of the Association just now, because they were so busy extending their plants and facilities in order to meet the present demands for their products. A few of the managers of manufacturing companies stated that, though personally fully convinced as to the value of the Association, they had not as yet been able to bring their directors to see it in quite the same light, or their directors had not given it consideration enough at the present time to enable them to commit themselves definitely to the complete programme put forward by the Association.

All the foremost American companies seem to be supporting the work of the Association, amongst those better known in England being the General Electric, the Westinghouse, the Allis-Chalmers, Roeblings, and the Crocker-Wheeler Companies.

A representative of one of the lamp companies in the course of the discussion referred to above stated that the total increase in the incandescent lamp business since the Association had started its work was about 20 per cent., and this he largely put down to the adoption of the methods advocated by the Association.

A central station engineer made a remark which has a good deal in it. He stated that before his management heard of the Association they thought their station was doing very well, and that they were using as much effort and energy to push things along as they could afford. When they first heard of the Association and the methods it was putting forward, they were not much impressed; however, they read the literature which was sent them from time to time, and then began to appreciate its value, with the result that now there seemed to be no limit to the field to be developed, and the prospects of the company were brighter than ever. He said, further, that the Association had been the means of showing that while they had been doing the best they could, they did not really know the best ways to set about getting new business. The number of incandescent lamps they placed orders for recently was ten times greater than in the previous year.

This story of success is one that should set British electrical manufacturers and central station managers seriously thinking as to whether it would not be of great advantage to form a somewhat similar Association in this country, not necessarily along the same lines as the American Association, but modified to suit the needs and customs of an older civilisation. The electrical industry, as a whole, cannot even in the present days of general prosperity be said to be in a very satisfactory financial position as far as profits on capital invested are concerned. The undeveloped field for the use of electrical apparatus is very great, so surely any successful means of development must place all concerned with the electrical industry in a much better position.

It cannot be disputed that if modern business principles are adopted, the connected load of any central station in the country can be very largely increased. As a proof of this statement, reference need only be made to the cases of Newcastle, West Ham, Ipswich, and a few other places. The argument may be brought forward that Americans are more progressive than ourselves, and also that they do not suffer from gas competition; this is not a fact, but only a general impression, which is true only of the larger cities, such as New York, Chicago, Philadelphia and Boston; it does not take a very lengthy residence in places other than these

larger cities, before the fact is appreciated that there are many Americans who are far from progressive, and that gas competition is a very serious factor in the older cities. In many parts of the States there is also the competition of cheap natural gas. The income *per cap.* of the average American city is only a trifle higher than that of the average English town, and it is only within the last year or two that American central stations have realised that it is essential to sell electricity along very much the same modern business lines as they would any other commodity. It is interesting to note also that this awakening has largely been brought about by the efforts of the Co-operative Electrical Development Association.

Since the question as to the formation of a British Association, having as its object the further development of the uses of electricity, is evidently a very important matter to all connected with the electrical industry, the writer would suggest that the reader of this article should convey his ideas on the matter to the "Correspondence" columns of the Electrical Review, so that the pros and cons may be fully discussed.

As Mr. J. R. Crouse, the moving spirit of the American Association, points out, the order of business development may be concisely summed up as follows:—Individualism; Co-partnership; Corporation; Consolidation; Association; Limited Co-operation.

That is to say, step by step, a natural tendency toward co-operation and to the recognition of broader grounds of common interest, resulting in a tremendous increase in the efficiency of production, with lesser gains in the fields of distribution or selling. The general principle of commercial co-operation and generic selling is essentially correct, and will probably be a matter of common practice, attracting no particular comment, in the near future. It is, however, difficult at present to get any but far-seeing men to assist in a general scheme which at first but indirectly affects them. If the scheme is a good one, and it certainly seems to be so, the apathy of the individuals who stand in the way of carrying it out must be overcome: the trouble involved in so doing will be well worth the effort. If necessary the work must be started without their aid—the results obtained will do much finally to convince them. The American Association has had many difficulties of this nature, which are gradually being overcome; undoubtedly the difficulties will be even greater here, but the potentialities of the general idea for popularising the use of electricity for light, heat and power are so great, that it is well worth while to overcome them.

THE COST OF ELECTRIC COOKING.

According to an abstract in the *Journal of Electricity, Power and Gas*, the following experimental results as to the cost of electrical cooking were obtained by Charlotte D. Seaver, B.S., and presented by her in a graduating thesis for the Degree of Bachelor of Science in Home Economics. The conditions governing the experiments were as follows:—

1. All articles were weighed or measured.
2. The amount of time required was reckoned from the instant that the current was turned on the apparatus till the operation of heating or cooking was completed.
3. With the exception of the whole meals, the same articles of food were cooked in coal, gas, gasoline and kerosene ranges, to obtain the relative costs, the fuel in each case being weighed or measured.
4. Electrical heating and cooking apparatus were obtained from different companies for these experiments.

Two groups of apparatus were employed; the first, designated as Apparatus (A), consisted of (*a*) Stove, 6 in., three heats; (*b*) Oven, 20 × 18 in., three heats; (*c*) Broiler, 9 × 12 in.; (*d*) Tea-kettle, 1 quart; (*e*) Stewpan, 2 quarts. The second set of utensils, Apparatus (B), consisted of: (*a*) Stove, 6·5 in.; (*b*) Oven, 18 × 10 × 16 in., three heats; (*c*) Broiler, 11 × 7 in., three heats; (*d*) Water heater, 1 quart. The only difference between the two sets was that oven A had heating coils in the top and bottom only, while oven B had coils in the sides also; both water heaters were of nickelled copper, A was locked to the stove and B had its own heater; A broiler had only one heat and B had three.

In baking and broiling the oven was heated before use, and current was switched off before completing the operation.

TABLE IV.—Results of Cooking with Coal, Gas, Gasoline and Kerosene.

No. of experiment...	XIII	XIV	XV	XVI
Fuel used	Coal	Gas	Gasoline	Kerosene
Time required, minutes—				
1. From cold to effective heating temperature ...	53	10	20	22
2. For baking specified... ...	32	45	30	43
3. Total time required for operation	85	55	50	65
Fuel required—				
1. From cold to effective cooking temperature ...	—	3 cb. ft.	0·0416 gal.	0·0312 gal.
2. For baking specified... ...	—	17 cb. ft.	0·0416 gal.	0·0468 gal.
3. Total fuel ...	10·5 lb.	20 cb. ft.	0·0832 gal.	0·078 gal.
Cost of fuel per unit	29/2 per ton	4/2 per 1,000 cb. ft.	7·5d. per gal.	7d. per gal.
Cost of baking operation ...	1·835d.	1d.	·624d.	·546d.

TABLE V.—Comparative Cost of Cooking with Various Fuels.

Source of heat for cooking	Electricity	Coal	Gas	Gasoline	Kerosene
Amount of energy or fuel required for given cooking operation	1·032 kw.-hour	10·5 lb.	20 cb. ft.	0·0832 gal.	0·078 gal.
Cost (assumed)	2d. per kw.-hour	29/2 per ton	4/2 per 1,000 cb. ft.	7·5d. per gal.	7d. per gal.
Cost of cooking by given source	2·064d.	1·835d.	1d.	·624d.	·546d.

TABLE I.—Results of Electric Heating and Cooking. Apparatus Set A.

TABLE II.—Apparatus Set B.

TABLE III. Apparatus Sets A, B. Meals Served.

No. of experiment	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Apparatus used	Stove and tea-kettle	Oven	Broiler	Oven	Oven	Broiler	Water heater	Oven	Oven	Oven, stove, broiler	Oven, stove, broiler, water heater	Oven, stove, broiler, water heater.
Operation	Heating water	Baking bread	Broiling	Baking cake	Baking	Broiling	Heating water	Baking	Baking	Getting breakfast for six	Getting luncheon for six.	Getting dinner for six
Article, kind	—	2 loaves	Beef steak	Angel food	4 apple pies	Beef steak	—	4 mince pies.	Beef roast			
Weight (total)	2 lb. from 45° to 212° F.	3 lb.	1·5 lb.	—	—	1·5 lb.	2 lb. from 42° to 212° F.	—	6 lb.			
Size, each	—	8 × 6 × 2·5 in.	—	10 in. tin	7 in. dia	—	—	7 in. dia.				
Time required, min.												
1. From cold to effective cooking temperature ..	—	25	5	15	25	10	—	30	20			
2. For operation specified ..	—	32	6·5	45	35	10	—	35	1 hr. 35m			
3. Total minutes	—	57	11·5	60	60	20	—	1 hr. 5m.	1 hr. 55m	1 hr. 45 m	1 hr. 50 m	2 hr. 30m
Energy required, kw.-hour.												
1. From cold to effective cooking temperature ..	0·1675	0·5795	0·115	0·3466	0·564	0·122	—	0·90	0·35			
2. For operation specified ..	—	0·4525	0·158	0·467	0·773	0·151	0·1271	0·70	0·96			
3. Total kw.-hours	—	1·032	0·273	0·8136	1·337	0·273	—	1·60	1·31	2·7	3·6	6·25
Cost of operation, based on charge of 2d. per kw.-hour	·335d.	2·064d.	·546d.	1·627d.	2·674d.	·546d.	·254d.	3·2d.	2·62d.	5·4d.	7·2d.	12·5d.

The advantages of electric cooking, although obviously more costly than other forms—so far as the first cost of the heat-producing agent is concerned—are pointed out as saving labour, no smoke, flame or soot; in fact, absolute cleanliness and the maximum of convenience. The author believes that, despite the price of electrical energy, reckoned on by her—viz., 4 cents per KW.-hour (2d. per unit), cooking by electrical means will win its way in favour, and even suggests that it may provide some sort of solution to the domestic service problem.

PROCEEDINGS OF INSTITUTIONS.

The Faraday Society.

"ELECTRONS AND ELECTROLYSIS."

MR. E. E. FOURNIER D'ALBE opened what proved to be a most interesting and fruitful discussion, at the meeting of the Faraday Society held on the 15th ult., on the Application of the Electron Theory to explain the phenomena of electrolysis. Sir Joseph Swan, F.R.S., was in the chair, and among those who took part in the discussion were Mr. John Rhodin, Dr. H. Borns, Dr. T. M. Lowry, Mr. F. Kaye, Dr. J. A. Harker, and Mr. N. T. M. Wilsmore.

The essential characteristic of the electron theory is that it supposes the electric current not to consist of the flow of a continuous subtle fluid, and not, as under the glamour of Maxwell's great theory once seemed probable, to be merely the outward manifestations of localised transformations of electro-magnetic into heat energy, but to be nothing more than the flow of an enormous number of minute discrete particles, units of electricity, and that these particles, whatever relation they may bear to the ether, are also the units from which are built up the atoms of the ordinary material elements. The theory, on the electrical side only, is thus not much different from Franklin's single-fluid theory, excepting that the units which it conceives are, by an unlucky choice of nomenclature, units of negative and not positive electricity, and that therefore the real electric current in a wire flows not from positive to negative, according to our present convention, but in the reverse direction. The difference between a conductor and an insulator is at once made easily manifest. In the former the electron, or a certain number of electrons, depending, perhaps, on the chemical valency of the element in question, is held but loosely by the parent atom, but the close packing of the latter renders interchange between the loosened electrons possible. These interchanges are continually taking place, but when they take place under the influence of some external potential gradient, an applied electromotive force, the electrons will in the periods of their freedom fall, on the whole, along this potential gradient, and so doing constitute an electric current. The whole of the new energy they thus acquire will, however, be frittered away in heat, caused by the innumerable jostlings which they encounter against the huge atoms continually blocking their free paths. Heating the conductor separates its atoms, causes free interchange of electrons to become less frequent, and therefore diminishes the conductivity. Conduction in a metal takes place *wholly by means of free electrons*, as the charged atoms (*i.e.*, the atoms which are deficient in or have an excess of electrons) are too closely packed to have any free paths, or any path at all except perhaps local oscillations about a fixed centre.

In an insulator, conductivity is rendered altogether impossible, because the electrons are too strongly bound up with the atoms or molecular groups ever to be free at all. But what will happen if an insulator is heated? Here we come to one of the most beautiful of the applications of the electron theory, the ease with which it explains the remarkable fact (pointed out the other evening in the discussion on Mr. Swinburne's paper at the Institution of Electrical Engineers) that there is practically no insulator which will not conduct as a solid electrolyte at a high temperature. If the insulator is an element, such as sulphur, probably nothing electrically new will happen, at any rate before the vapour stage is reached, but if the insulator is a compound, the application of heat will in time cause so much tumult within the molecules that some of them will split up into sub-molecular groups—dissociate, in the language of the chemist. Now these sub-molecular groups will most likely, being differently constituted, have different powers of attraction for electrons, and the result will be that one of the groups will take with it an excess, and the other will be left with a deficiency of electrons. In other words, the solid will be "ionised," it will contain free charged atomic groups, and therefore under the influence of a potential gradient the positive ions will move in one direction and the negative in the other, and the motion of both will constitute electrolytic conduction. There may in addition also be free electrons if the attractions of the sub-molecular groups for these are not so very great at high temperatures, and if so, the body will conduct metallically as well as electrolytically.

The solid electrolyte forms a link between metallic and ordinary electrolytic conduction. In both cases of electrolytic conduction, the necessary preliminary is dissociation, but whereas in solids this is brought about by heat, in liquids it is brought about by the process of solution itself by the presence of the solvent. We are not very clear as to exactly *how* it is brought about—this is one of the outstanding problems of physico-chemical theory. Dissociation having taken place, one of the atoms—for example, chlorine, in the case of a solution of hydrochloric acid—will take with it, on account of its superior attraction, an extra electron, and so become negatively charged, while the unfortunate hydrogen atom will be left denuded of an electron, and therefore positively charged. But now a new development sets in. Prof. J. J. Thomson has shown that when a charged drop of water evaporates, its electric charge remains, and since its potential increases as its diameter diminishes, more energy is required to evaporate a charged drop than an uncharged drop. Condensation on the drop, on the other hand, therefore involves an expenditure of available electric energy, and thus condensation is facilitated. Our freshly formed positive and negative atoms in solution act precisely as do ordinary charged drops of water, and they cause to collect round themselves, not more of their own kind—there is too little of that present—but molecules of the solvent, which, of course, abound in all directions. Our solution finally contains, then, a certain proportion of the molecules of the solute dissociated into positively and negatively charged atomic nuclei surrounded by a burdensome cluster of parasitic molecules of the solvent. It is these loaded nuclei that constitute the "ions" of the electrochemist. Mr. W. R. Bousfield has, by applying the laws of viscosity, made some elegant calculations concerning these charged clusters; he finds, for example, that a chlorine ion attaches to itself in solution five water molecules. In this way the electron theory reconciles the old dispute between the advocates of a dissociation and those of an association or the "hydrolysis" theory of solution. Both of these concepts are true, and both necessary for a complete understanding of the problem of solution and electrolytic conduction. There is, it is true, one outstanding difficulty here that needs explanation. How is it possible for the charge embodied in such an ionic cluster to distribute itself over the surface of the group? If it did not do so, it would appear to have no external effect. The point will doubtless receive some further elucidation from the students of the electron theory.

Our solution now contains loaded ions, positive and negative. Unlike the hot solid electrolyte it will not contain any free electrons also, because, on account of the comparatively small resistance offered by a liquid to these minute bodies, their mobility will be too great to allow them to exist free in solution. The comparatively large loaded ions will not, of course, be very mobile, and neither will the mobilities of different ions—even at the same temperature—be the same, on account of their different degrees of hydration, suppositions amply confirmed by observations on the different mobilities of the ions, which are thus, for the first time, clearly explained. The figures are to be found in any text-book of electro-chemistry. It is not, perhaps, realised how very large some ions really are. An ion containing some 50 or 60 atoms will have a diameter of about a micromillimetre, and its motion can, therefore, probably be observed in Szigmondy's ultramicroscope, an apparatus which utilises a beam of exceptionally powerful light to study the positions and motions of bodies too minute to be actually seen, but whose positions can be made known through diffraction effects on the rays of light. Mr. Fournier holds out the possibility that the motion of such heavy ions may be studied by actual observation, and that they may be watched as they cover a distance of 1 cm. in an hour and a half under the influence of a potential gradient of 1 volt per cm. It will then become a comparatively simple calculation to find the diameter of such an approximately spherical ion moving through a viscous liquid, or, in the last resort, threading its way among molecules of perhaps half its diameter. It was similar calculations on the settling down of ions, made visible by condensation of moisture, that led J. J. Thomson to the formulation of his electron (or corpuscular) theory to explain electric discharges in gases and elsewhere, and Mr. Fournier thinks that the future development of electrolytic theory will lie in the direction of similar statistical analysis of the motions of the ions through the electrolyte and into the electrodes, and in the complete determination of the energy transformations at each stage, based on direct observation, and on further quantitative studies of the mobilities and degrees of hydration of the ions.

Returning now to our present applications of the theory, it will be interesting to compare a centimetre cube of copper with a centimetre cube of, say, millinormal hydrochloric acid, each carrying a current of 1 ampere. The copper conveys its current almost solely by its free electrons, some 400 trillion in number, which, on account of their minute size, possess a mobility some 100 million times greater than that of a hydrogen ion. The hydrochloric acid conveys the current by means of its heavily-laden hydrogen and chlorine ions, which, in a millinormal solution, amount to about two trillion. Since the current is the same in each case, the electrons in the copper must move some 200 times more slowly than in the electrolyte. But this is not usually the case, for in a copper wire 1 mm. in diameter conveying 1 ampere the speed of the electrons is of the order of 1 cm. per second. The greatly superior mobility of the free electrons brings it about that a much lower voltage is required to maintain an ampere in a copper conductor than in a liquid conductor of the same dimensions.

The migrations in opposite directions of the hydrated positive and negative ions under the influence of an external electric force constitute the current in an electrolyte, just as according to the old ionic hypothesis. But the electron theory gives a new and beautiful explanation of what takes place at the electrodes. The atoms of these are so tightly packed that no other atoms—still less hydrated atoms or ions—can force themselves between them. Nor under ordinary circumstances can even electrons pass one way or the other, because although interchange of electrons is frequent within the mass itself of a metal, at the surface the close packing of the atoms loses its effect and renders free trade in electrons across the boundary impossible. The surface, in fact, is a semi-permeable medium, and the pressure exercised by the electrons on one side is the exact equivalent of ordinary osmotic pressure in solutions. It is Nernst's solution pressure. But if now the driving force exceeds

a certain minimum value, so as to overcome the electron osmotic pressure, an electron *is* able to pass, say, into a hydrogen ion and neutralise its positive charge. The result is that the hydrogen ion becomes a hydrogen atom, loses its condensing power, drops its attendant satellites of water molecules and escapes as free gas at the electrode; the reverse happens at the anode. The minimum driving force necessary is, of course, the well-known minimum E.M.F. (decomposition potential) required in order to effect electrolytic decomposition in any particular case.

This conception of what takes place at the electrodes is of great value in giving a simple picture of some of the well-known oxidation and reduction electrode effects, which otherwise are often so difficult precisely to follow. Mr. Wilsmore at the meeting gave some illustrations of the explanation of these in the light of the electron hypothesis. It will suffice here if we take as an example the reduction of the peroxide plate of an accumulator. Previously chemists have had to assume either the existence of lead peroxide ions (Liebenow) or else of tetravalent lead ions (Le Blanc). On the electron theory the negative electrons pass in the opposite direction to the current from the peroxide electrode into the hydrogen ions. The latter are immediately neutralised, the former left with a deficiency of electrons or a positive charge which attaches itself to the lead in preference to the oxygen. The bond between the lead and oxygen being thus loosened, free lead is formed, and the hydrogen and oxygen unite to produce water. Fresh electrons from the outside circuit flow into the lead to make up the deficiency there, and thus the flow of current is kept up. The action may be symbolised as follows ($\ominus$ stands for a negative electron):—

$$PbO_2 + 4\overset{+}{H} + 2\ominus \rightleftarrows \overset{++}{Pb} + 2H_2O.$$

We have some very direct evidence that the electro-chemical activity of a metal is a function of its dislike for, or the ease with which it drives away, electrons from its atoms. It is a well-known fact that ultra-violet light is an effective stimulus in causing metals to dissipate a negative charge (*i.e.*, to throw off electrons), and it has now been shown that the more electro-positive a metal is in the electro-chemical series, the more is it affected by ultra-violet light. This direct evidence of the similarity of the processes of electric discharge and electrolytic conduction is of considerable interest, and is an important argument in favour of the theory.

The electron theory has been pre-eminently successful in unifying and co-ordinating the most diverse phenomena in electricity and magnetism in such a way that all may be interpreted in terms of one simple and fundamental conception. Invented originally to explain the discharge of electricity through gases, it has been adapted in a manner that is truly astounding to explain radio-activity, the Zeeman effect, and the structure of the atom demanded by that effect, the periodic system of the elements which in the light of J. J. Thomson's marvellous investigations we may picture as being a necessary result of this atomic structure, the facts of magnetism and of electro-magnetism, and finally the conduction of electricity through wires, solid electrolytes and solutions. Here it has had to harmonise itself with an existing theory of solution and electrolysis, based on altogether different considerations, and it has fallen in with a completeness that is noteworthy. But ultimately chemical action itself will doubtless prove to be in its essence electro-chemical, and so the electron theory may hope to gather within its fold the whole vast fabric of the chemical, as it has already absorbed the various aspects of the one electrical science which are included under the heading of physics.

Fuel Economy.

By H. B. Maxwell, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers *at Glasgow, December 11th*, 1906.)

In order to secure the utmost economy, records must be kept of the water pumped into the boilers, the coal used, the units generated, and, if possible, the steam used by the engines. The evaporation per pound of coal, the coal and water used per unit, &c., are then easily deduced, and losses detected.

With a good conveyor, 1 unit of electricity will suffice to lift 10 tons of coal 30 ft. to overhead bunkers, with a bucket conveyor 200 ft. long. An elevator and trough conveyor for a plant burning 1,500 to 2,000 tons of coal per annum costs £200 to install, and not more than £40 per annum for maintenance, including 10 per cent. for interest and depreciation.

The author is of opinion that a mechanical stoker pays in all cases, enabling cheap bituminous coal to be burnt without smoke, reducing the cost of labour and increasing the output. For smokelessness the furnace and combustion chamber must be entirely constructed of firebrick, with ample space for combustion to be completed before the gases are cooled by contact with the boiler-heating surface. Air leakage at the back of the grate must be carefully excluded; it is preferable to dump the coal before it is completely burnt, rather than to have the grate bare at the back, as the the remaining heat is given off without waste.

CO_2 recorders should be used, and the percentage of CO_2 in the flue gases maintained at 12 or 13. Admission of excess of air is one of the chief causes of inefficiency with hand-firing. Imperfect combustion and a low CO_2 reading, due to excess of air, may take place without smoke, and thus pass undetected in the absence of a recorder. A draught gauge is also very necessary.

The coal should be purchased on a calorific value basis, and regularly tested. Frequently coals of lower calorific value give a higher evaporation per pound of fuel than those of higher value, so that the latter are not necessarily the most economical. For economical working it is essential to maintain all the boiler mountings steam-tight, and the very best mountings should be used.

Electrically driven auxiliaries are more economical than steam driven, and their energy consumption can be constantly measured.

The author advocates the use of an economiser, air heating, induced draught fan instead of chimney, and live steam heating of the feed-water. The air heater should be between the economiser and the fan. Two fans to take the place of a chimney 200 ft. high dealing with the products from 10,000 lb. of coal per hour, would produce a better draught at one-third the capital cost, and would reduce the loss of heat from 10·6 to 2·4 per cent., while using only the equivalent of about 1 per cent. of the total evaporation for power and maintenance. Other advantages are saving in capital cost, increased output, saving in labour and repair, and greater flexibility.

The increased efficiency due to thermal storage has reached 25 per cent., and duties of over 13 lb. per sq. ft. of heating surface per hour have been obtained, with chimney draught alone. Such enormous economies and duties are almost inexplicable. With four water-tube boilers having 3,000 sq. ft. of heating surface each (one being spare), capable of evaporating 50,000 lb. of water per hour with fan draught and pump feed, an output of 100,000 lb. of steam per hour could easily be obtained during periods of heavy load, with the aid of thermal storage. The economiser and feed pumps could also be of smaller capacity.

Flues should be short and air-tight. Steam ranges often give trouble, unless well designed and properly erected, without initial strain. Solid-drawn steel pipes are best, with wrought-steel flanges riveted on, and screwed in addition when over 6-in. bore; branches should be riveted. The pipes should not be larger than necessary.

Superheat is very necessary to economy, even when only carried to a moderate degree, as it saves not only coal, but also in maintenance of piston rings, valves, packings, &c. By interposing a low-pressure turbine between the engine exhaust pipes and the condenser, a further economy can be effected.

Discussion.

Lord Kelvin, in a communication, referred to the possible danger of explosion of the thermal storage vessel, such as that which recently took place at Greenwich with disastrous results.

Mr. W. W. Lackie (Glasgow), in a communication, said that one serious objection to the Lancashire boiler was the periodic reduction in the steam pressure which the insurance companies asked for, as time went on; there was no such process as that to go through with a water-tube boiler. Mr. Maxwell clearly pointed out that the only conditions under which smokeless combustion could be got were those obtaining when the combustion chamber was of a correct design. It frequently paid to use a poor quality of coal, as for many hours in the day the boilers were banked. He did not look forward to the day when large boilers would not be supplied with a good chimney stack. Induced draught fans had been installed in connection with all the Glasgow Corporation electricity works chimneys, and had been found most useful in meeting sudden demands upon the stations at times of heavy fogs. Besides creating a draught, a chimney also performed the very useful function of carrying the products of consumption to a proper height in the atmosphere.

Mr. J. K. Stothert (Glasgow), in a communication, said that thermal storage drums were useful but expensive accessories. The saving obtained was not sufficient to justify the capital expenditure, and stations supplying cities, where all-day fogs had to be contended with, could not possibly depend on thermal storage. He did not not believe that the exceptionally high evaporations or efficiencies claimed, had ever been obtained. He thought Col. Crompton, Mr. Miller and others had been misled. The chief engineer of the County of London Electric Supply Co., Mr. C. P. Sparks, informed him that he was unable to obtain any appreciable increase of evaporation beyond what was accounted for by the increased temperature of the water. At Marylebone they found thermal storage useful in assisting them over an exceptional peak load, but had not found any increased evaporation beyond the 10 per cent. to 25 per cent. which they expected. There was no doubt whatever that the results obtained had been greatly exaggerated. Every station should have some means of ascertaining at any moment the steam consumption of the plant. At Bankside the switchboard attendants could see the total being discharged by their pumps at any instant. This was entered on the quarter-hourly reading sheet with the KW., and the water per KW. was stated every quarter of an hour. All the central station record coal costs were held by stations using chain-grate stokers, the lowest being Carville, and following that, Glasgow and others. The deposit of unburnt coal on the dumping bars was quite unnecessary. Regarding the CO_2, it did not pay to go much beyond 12 to 12½ per cent. The fixing of draught gauges on each boiler was certainly a good suggestion. The draught gauge should be fixed on the fire door, where it was easily seen by the firemen, and gave the draught over the fire. That system was also adopted at Bankside with satisfactory results. The buying of coal was certainly one of the most important duties of central station engineers, and every engineer would agree with Mr. Maxwell that the ideal in this direction was to buy British thermal units, and not coal, but he would find very few coal contractors in Great Britain who would accept a contract of this sort. He only knew of one station in London where the contract had been fixed on this basis, and that was the Islington Corporation Station. The best information that they could have in this direction was that contained in the specification drafted by the chief engineer of the

Rapid Transit Railway of New York, Mr. Stott, in connection with his coal contract.

Mr. A. J. Abraham (Cambuslang), in a communication, remarked that he did not think anybody could convey 2,000 tons of coal a year for any distance, including power and up-keep, for £20 per annum, as the author stated. Superheat doubled the oil bill, and was liable to injure the engines. He did not think that mechanical stokers paid in small boiler installations. Taking into account wear and tear of the boilers, it was doubtful whether greater economy could be obtained by the use of mechanical stokers. In Cambuslang he burned dirty dross at 5s. a ton (delivered into the bunker) without smoke, and maintained an average of 10·83 per cent. CO_2 in the flue gases. A good man stoker could force a boiler far better and more economically than a mechanical stoker. In their destructor flues they exceeded 12 per cent. CO_2.

Mr. Robertson (Greenock) said that for a small installation the expense of maintenance would sometimes outweigh any advantage to be derived from the mechanical stokers, where there was no direct saving in labour. He found that stoker repairs worked out at about 2d. per ton of coal. Messrs. Babcock & Wilcox had devised an arrangement whereby they could shut off the air at the back of the chain grate. With regard to induced draught, he differed with Mr. Maxwell. When a chimney had been put up it cost nothing, and was easily controlled. The saving referred to by Mr. Maxwell in using a fan was based on the assumption that the heat represented by the difference in temperature between the outlet gases and the atmospheric temperature could all be recovered for feed water heating. That could not be done except at great capital expenditure. The question of fuel economy could be overdone.

Mr. Raphael (London) referred to the figures given by Mr. Maxwell in regard to thermal storage, and said he thought these were the same as those mentioned by Colonel Crompton three years ago. If three years had elapsed and the results had not been confirmed, they were entitled to be a little sceptical about them. As to the explosion in London, he thought it was pretty well agreed that the accident was due to a water hammer which weakened the tank at one point.

Mr. Creasy (Partick) said that tests made with the calorimeter, took less than half an hour after the coal had been dried. The chief trouble was getting the coal perfectly dry and perfectly ground. Samples were taken immediately the coal arrived, and if after a second test the calorimeter value did not come up to the standard specified, the whole boatload was rejected.

Mr. Bagshaw (Glasgow) preferred the forced draught system, with which it was only necessary to have a fan large enough for the air without the waste gases. Mechanical stokers admitted a great deal too much air, especially when the full load was on. One of the largest firms of steamship owners in the country had installed mechanical stokers, and had effected a saving of something like one-third on the coal bill over a year's running in one ship, and the coal consumed per 1 H.P.-hour was 15 per cent. lower than any public record up to the present.

Mr. Maxwell, in replying to the discussion, said he had had chain grate stokers working in his boiler house for three years, and he did not think they had cost 7s. for repairs. The cost of upkeep of a chimney might be nil, but the capital charges on it were a much heavier item than the charges for the upkeep of fans. He did not believe that water hammer had really anything to do with the Greenwich accident. He had not found the slightest increase in oil consumption with superheaters. As to forced draught, it was difficult to apply where they had chain grate stokers. The radiation from thermal storage vessels was negligible. With regard to the calorific value of coal, in Partick they had a contract fixed up on terms somewhat similar to those obtaining in the coal contract at Wolverhampton by Mr. Shawfield. Instead of paying on the calorific value of the coal, they stipulated that it should not fall below a certain figure. He had not had to refuse any coal.

Recent Improvements in Electric Lighting.

At a general meeting of the Institution of Electrical Engineers (Birmingham Section) on Wednesday, January 16th, 1907, Mr. R. A. Chattock, chairman of the Section, presiding, the above subject was discussed.

Mr. A. H. Bate, who introduced the subject, said that the cost of lamp renewals with the ordinary incandescent lamp did not exceed something like 5 per cent. of the total cost, and with energy at the usual rates of 4d. and 6d. per B.T.U., no reduction in the cost of the lamp itself would be of any real benefit to the consumer. No doubt in the near future they would be able to choose between several kinds of metal filament lamps, but, at the moment, the only lamp which was being used on a large scale was the tantalum lamp. This was not at present made for pressures above 130 volts. There were only two sizes of wire being used in the manufacture of these lamps, one size being suitable for the ordinary lamp giving 23 c.p. on 110 volts, and the other size being used for the "Sun" lamps giving 45 c.p. at the same pressure. Owing to the way in which the filaments were wound, there was a comparatively small candle-power directed downward in the direction of the axis of the lamp. To provide a more uniform distribution of the light, the tip of the lamp was frosted. The life of different individual tantalum lamps varied considerably. An extended experience showed that at normal voltage, and if the lamps were not over-run, they had an average efficient life up to the time the c.p. dropped 20 per cent. of 600 to 700 hours. During the first 40 or 50 hours of life the resistance fell about 3 per cent., and then remained practically constant throughout life. While the resistance was falling the candle-power naturally increased, and then, as the globe slowly blackened, fell off again till in about 700 hours it had fallen 20 per cent. below the marked figure. By running a lamp something like 10 volts below its marked figure an efficiency of 2·2 watts per candle was obtained instead of the usual 1·7 watts per candle, and the efficient life was then increased to about 1,200 to 1,400 hours. Mr. Bate then showed that if energy could be obtained at 1d. per B.T.U., no particular advantage could be claimed for tantalum as compared with carbon-filament lamps; but with higher rates per B.T.U., the tantalum lamp gave a considerably decreased cost, even reducing the current bill to one-half. He had made this comparison on the basis of the cost per 1,000 c.p.-hours. Taking the cost per lamp the advantage of the tantalum was not so marked, as one usually replaced a 16-c.p. carbon filament lamp with a 23-c.p. tantalum, and the advantage was shared between decreased current bill and increased illumination. The behaviour of the tantalum lamp on an alternating current circuit was very remarkable. He had known lamps running with equally satisfactory results on circuits of 50 and 100 cycles. The only thing to do was to give some lamps a few months' trial, and if they survived the first 200 or 300 hours, it would probably be quite satisfactory to use them on that particular circuit. The cause of such uncertain results was not at present known.

Mr. A. Lindsay Forster had made out a table showing the complete costs for running some different forms of lamps. The chief difficulty in constructing it had been to know the candle-power at which to rate the various lamps. For instance, the figures given for flame lamps with chemically treated carbons varied in his own experience between ·22 and ·45 watts per m.h. candle-power. The amount of time allowed for trimming was worked out on the basis of very irregular hours of burning. As the mercury vapour lamp was, of all the high candle-power units, the one which ran the longest, he arranged to run two 5-ampere single-enclosure arc lamps in a shop ordinarily lighted by two mercury vapour lamps. The positions of the arcs were chosen so that the illumination should be similar in its distribution. The result was that no ordinary observer could notice any difference between the two different lights. The mercury lamps consumed about 3·5 amperes running two in series on 220 volts, so that the consumption of the arc lamps was 1·40 times as much. Of the mercury lamps, one had a new tube, and the other had run about 600 hours. The useful length of the lamp tube used was 45 in., and the candle-powers were respectively 682 and 675 mean candle-power. The watts per candle were ·58. The mercury light required only 70 per cent. of the generator capacity required by the arc, and the advantages due to long running hours were very great (especially in any situation where the lamp was used for a very variable number of hours) owing to the absence of trimming of any sort.

Costs of Running for 1,000 Hours on 220-volt d.c. Installation.

Flame Arc.—9-amp. 17-hour, with "chemical" carbons.

2,000 units, at 1½d.	...	...	£12	10	0	
Carbons	...	...	4	10	0	
260 trims (wages)	...	...	2	3	4	
Repairs	...	...	2	8	0	
Four lamps	...	...	£21	11	4	Per lamp, £5 8 0

Flame Arc.—7-amp. 40-hour (magazine) with chemical carbons.

1,650 units, at 1½d.	...	...	£10	6	3	
120 trims (wages)	...	...	1	0	0	
Carbons	...	...	1	10	0	
Repairs	...	...	3	0	0	
Four lamps	...	...	£15	16	3	Per lamp, £3 19 0

Single Enclosed Arc.—5-amp. 120-hour.

1,100 units, at 1½d.	...	...	£6	17	6	
Carbons	...	...	0	2	0	
24 trims	...	...	0	4	0	
Repairs	...	...	1	0	0	
Two lamps	...	...	£8	3	6	Per lamp, £4 1 9

Mercury Vapour.

770 units at 1½d.	...	...	£4	16	3	
Renewals at 1,500 hours	...		3	1	0	
Cleaning and repairs	...		0	15	0	
Two lamps	...	...	£8	12	3	Per lamp, £4 6 0
If life of tubes 800 hours	...		£11	5	3	Per lamp, £5 12 8

High pressure gas, say, 350 c.p., gas at 1s. 9d. per 1,000 cb. ft. Cost, including mantles, attendance, by-pass, &c., per 1,000 hours, £4 6s. 3d.

Mr. F. H. Craig (of the British Westinghouse Co.) said the efficiency of the flame arc lamp might be taken at about ·24 watt per c.p. mean spherical illumination. Taking a big erecting shop, say, about 200 ft. long, with the Birmingham Corporation supply and prices, to illuminate that shop well with enclosed lamps took 9s. per hour. Taking the flame arc lamp, and giving half as much more candle-power, it worked out at 2s. 11d. The mercury vapour lamp was not so efficient as the flame arc lamp; it took a shade under ½ watt per c.p. The mercury vapour lamp gave a softer and

better illumination than an arc lamp giving much more candle-power. With illuminations from 1 to 2 c.p. per sq. ft., satisfactory results had been obtained. It had been placed at various heights from 11 ft. to 50 ft., in each case with satisfactory results. Taking the shop he had referred to, and assuming that the roof was lower, and consequently the mercury vapour lamp was more suitable, the same illumination could be obtained as was given by the arc lamp for 4s. 4d., or just about one half. The life of a lamp was 1,000 hours on an average. Many burned out quite quickly, and that was due to the difficulties at present encountered in the making, but defective lamps were easily detected after a few hours' burning. There were already some 200,000 c.p. in the Birmingham locality alone.

Dr. D. K. Morris said the resistance of a tantalum filament increased about six times when it was heated, while carbon went down about 60 per cent. His brother had been the first to point out that the great increase in the resistance might have the effect, where numbers of these metallic filament lamps were used, of making it impossible to utilise the magnetic circuit breaker, as it would be pulled out. The peculiar behaviour of the tantalum lamps with alternating currents was very likely due to the wave form of the circuit.

Mr. Kemp asked if there was any likelihood of the present hideous colour of the mercury vapour light being improved upon.

Mr. Craig, in reply, expressed a personal preference for the colour of the mercury vapour light. For working by, it was a good lamp and the light was of good quality. Men engaged in workshops who had objected to its first introduction would not now be without it. In his figure he had taken no capital charges or renewals, only the cost of the current. The cost of carbon for the flame arc lamp amounted to 2d. for 100 c.p.-hours. The cost of a mercury vapour lamp was, say, 50s. for 1,000 hours; there was no labour cost.

Dr. Sumpner referred to the increase of light owing to diffusion. Glow lamps were generally used in rooms, arc lamps in very big places, workshops or open spaces. If they compared an ordinary room with one having the same lighting but with glass walls and roofs, they would find about twice as much illumination in the former as in the latter. The difference was not due to any merits or demerits of the lamp, but to the reflection of the light. With whitewashed walls and ceilings, the light due to continual reflection might be increased as much as five times. Taking an average case the walls reflected about 60 per cent., and the light was really increased twice. With arc lamps that did not apply because they were not used in the same way as a rule. The measurement of the candle-power of such a light as that of the mercury vapour lamp was by no means easy. If they had a diffusing reflection reflecting 80 per cent., and a mirror reflecting 80 per cent., and measured the candle-power normal to the surface, it would be found the diffusing reflection sent off twice as much light as the mirror did, although the total amount of light reflected was the same in both cases. The effect of lighting depended on the eye as well as on the light, and the sensitiveness of the eye might vary enormously under different conditions. With a mercury vapour lamp or inverted arc, the first impression undoubtedly was that the room was badly lit, but it would be found much better to work in than a room appearing to be brilliantly lit, a room full of lights which dazzled the eye.

Mr. Tweedy said he would like to ask station engineers how they would now explain to the consumers the advantage of the 220 or 200-volt supply. He thought it was a great pity from the consumers' point of view they ever departed from the 100 volts, because all the new lamps required low voltages if they were to work as single units. As to diffusion of light, he suggested that lighting engineers should go very strongly for the more scientific illumination of retail shops. The best lit shop was the shop lit by concealed light and diffused light.

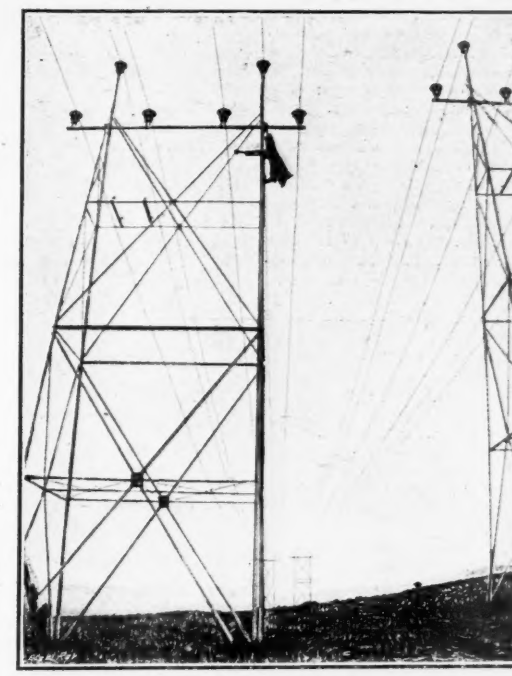
Mr. Fennell spoke of the difficulty of getting supplies of the Osram and tantalum lamps. The tantalum lamps varied in regard to current up to about 20 per cent., and on attempting to put them in series the result was disastrous. People did not light their shops that the public might see their goods, but to make the public come in and see what was inside—the light was an advertisement.

Mr. Holden said mercury vapour lamps could not be used on low voltages, but Mr. Craig said the mercury vapour lamp was made for voltages as low as 50.

Mr. Bate replied to the discussion, and a vote of thanks to him concluded the debate.

HIGH PRESSURE TRANSMISSION IN MEXICO.

The country through which the overhead lines of the Mexican Light and Power Co.'s system are run from the generating station at Necaxa to Mexico City, about a hundred miles distant, is almost entirely populated by Peons—that is, Mexican Indians, who are generally classed as the most unintelligent race of natives in America. Before the current was first transmitted a year ago, these Indians were constantly cutting off lengths of the copper wire, and appropriating the same, and the company were put to great expense in guarding the lines, and also in instructing the natives as to the danger of their depredations, but all to no purpose, the consequence being that when the pressure of 60,000 volts was put on the lines, it was usual to have four or five momentary interruptions every week; on account of this the Federal Government of Mexico passed a law making it a capital offence for any unauthorised person to interfere with the lines, or in any way to cause an interruption of the supply. This, to a great extent, has stopped the evil, but even at the present time an occasional Peon meets his death as a result of his curiosity or his love of stealing.



High Pressure Transmission in Mexico.
The fate of an inquisitive native.

The accompanying illustration shows a case which happened quite recently. On this occasion, according to natives who witnessed the occurrence, two Peons climbed the tower at the same time. The one who is seen in the photograph first touched the line; this caused an arc, which struck the Peon who was beside him, and he fell to the ground; the one who touched the line was held there, and this caused a heavy disturbance over the system, and knocked all synchronous apparatus out of step. When the line switch was finally opened at the generating station after a lapse of about 30 seconds, which is the time that is generally allowed in case of a short circuit in the hope of its clearing itself, the Peon fell into the position seen in the photograph, one of his feet having caught in the top of the tower. Here his body was found by the line patrolman a few hours afterwards, the native spectators having fled when the catastrophe occurred.

LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.]

No. 70.—Electric Lighting.—Whether Provisional Order Necessary or Expedient.

"460 Volts" writes:—"We propose to form a small company for the electric lighting of a suburban district in the jurisdiction of a Rural District Council.

"Owing to the scattered disposition of the houses, it will be imperative at first to utilise overhead distribution, in order that the venture may be a commercial success; even under these circumstances it will pay no dividend for the first year.

"We do not contemplate any opposition by the R.D.C. or by the residents, except, perhaps, in the case of one landowner.

"(*a*) Is it essential or desirable to obtain a provisional order? (*b*) If one is obtained, will it prevent or hinder any other company from entering into a competitive supply, and, once obtained, (*c*) what particular privileges does it bestow, more especially as regards wayleaves? (*d*) Will any particular difficulty be experienced in obtaining a provisional order for a system with overhead distribution?"

*** With regard to (*a*), it seems that the supply of a whole district is contemplated, and that the mains are to be carried overhead. There is no reason why the expense of a provisional order need be incurred. If it were necessary to lay wires under streets, and the Rural District Council (acting in their capacity as

highway authority) refused to allow the streets to be uprooted, statutory powers would become necessary. It has been often pointed out in these columns that there is nothing to prevent a man carrying wires over a street or highway, if he complies with the Board of Trade regulations and the local by-laws, if any, and obtains the consent of the landowners on either side of the street to place the supporting poles on their land.

(*b*) If a provisional order were obtained, it would not prevent the grant of another order, although the fact that the district was well provided with electric light would certainly be taken into consideration before another order was granted.

(*c*) A provisional order confirmed by Parliament has all the force of a statute. It enables the "undertakers" to lay their wires under streets and highways; limits the amount which they may charge for energy; and compels them to supply any consumer who demands a supply.

(*d*) It will be necessary to satisfy the Board of Trade that overhead distribution is essential. The only difficulty of working a provisional order on the overhead system lies in the fact that in those circumstances the consent of the local authority must be obtained before wires are suspended over any street or highway.

Generally, "460 Volts" is recommended to consult his solicitor before he moves in the matter.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

1,628A/06. "Improvements in and relating to electro-plating apparatus." A. Schmitz. (Date applied for under Rule 5 of the Patents Rules, 1906. January 22nd, 1906.) January 21st. (Complete.)

1,499. "Improvements in or relating to the production of continous electrical oscillations for therapeutic purposes and to the application of the same." H. Manders. January 21st.

1,500. "Improved terminal for electrical purposes." A. Austin. January 21st.

1,513. "Improvements in apparatus for electrically lighting the mouth and cavities beyond, during dental or other surgical operations." C. Garfitt and J. Baxter. January 21st.

1,517. "Improvements in the construction of choking coils for alternating current testing." R. K. Morcom and J. M. Walsh. January 21st.

1,520. "System of wireless telegraphy by Hertzian waves." I. Hettinger. January 21st.

1,531. "Automatic time indicator for telephone talkers." D. Cunningham. January 21st.

1,548. "Improvements in or relating to telautographic systems." A. Korn. January 21st. (Complete.)

1,549. "Improvements in the production of discharge effects on textile fibres or fabrics." G. W. Johnson. (Kalle & Co., Aktiengesellschaft, Germany.) January 21st.

1,585. "Improvements in and relating to machines for use in the manufacture of incandescent electric lamps." The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) January 21st.

1,587. "Improvements in and relating to telephone switchboards." H. H. Lake. (Kellogg Switchboard Supply Co., United States.) January 21st. (Complete.)

1,596. "Improvements in and connected with electrically operated switches especially applicable to railway and other vehicles." C. A. Park and C. L. Mason. January 21st.

1,627. "New or improved wireless telephone system." S. Musits. January 22nd. (Complete.)

1,645. "New or improved apparatus for electrically indicating music notes upon the keyboard of a pianoforte or other similar instrument." A. R. Hakoumoff. January 22nd.

1,658. "Improvements in electric smelting furnaces." E. A. A. Gronwall, A. R. Lindblad and O. Stalhane. (Date applied for under Patents Act, 1901, January 26th, 1906, being date of application in Sweden.) January 22nd. (Complete.)

1,659. "Improvements in arc lamps." M. Schneider. January 22nd. (Complete.)

1,662. "Improvements in alternating-current commutating electric machines." Allgemeine Elektricitats Ges. (Date applied for under Patents Act, 1901, January 23rd, 1906, being date of application in Germany.) January 22nd. (Complete.)

1,663. "Improvements in and relating to electricity meters." A. May. January 22nd. (Complete.)

1,665. "Improvements relating to telephones." A. G. Kountz. (Date applied for under Patents Act, 1901, January 22nd, 1906, being date of application in United States.) January 22nd. (Complete.)

1,671. "Improvements in incandescent vapour lamps." W. Tures. January 22nd. (Complete.)

1,686. "Improvements in electric service-motors." M. Coudé. (Date applied for under Patents Act, 1901, January 23rd, 1906, being date of application in France.) January 22nd. (Complete.)

1,713. "Improvements in electric fuses." A. Eckstein and A. C. Heap. January 23rd.

1,716. "New or improved electro-magnetic motor." E. Turner. January 23rd.

1,752. "Improvements in and relating to electric arc lamps." E. R. Grote and M. V. Ely. January 23rd.

1,754. "Improvements in wireless telegraphy." L. H. Walter. January 23rd.

1,759. "Improvements in or relating to radio-telegraphy." E. Raymond-Barker. January 23rd.

1,781. "Improvements in magnetic clutches." H. W. Ravenshaw, V. G. Middleton and W. E. Townsend. January 23rd. (Complete.)

1,783. "Improvements relating to electric apparatus for recording on the staff notation music played on key instruments." K. Koppensteiner. January 23rd.

1,785. "Improvements in and relating to electric incandescent lamps." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) January 24th.

1,786. "Improvements in and relating to vapour electric apparatus." The British Thomson-Houston Co., Ltd. (General Electric Co., United States.) January 24th.

1,793. "Improvements connected with electric arc lamps." H. S. Martin. January 24th.

1,801. "Improvements in electrical switches." C. M. Dorman, R. A. Smith and H. G. Bagge. January 24th.

1,840. "Improvements in sparking plugs for internal combustion engines." R. Bosch (trading as the firm of R. Bosch). (Date applied for under Patents Act, 1901, February 24th, 1906, being date of application in Germany.) January 24th. (Complete.)

1,854. "Improvements in protective devices of the type known as lightning arresters." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) January 24th.

1,855. "Improvements in and relating to alternating-current distribution systems especially applicable to electric railways." The British Thomson-Houston Co., Ltd., and J. E. Woodbridge. January 24th.

1,856. "Improvements in and relating to devices for suspending overhead electric conductors." R. L. Acland. January 24th.

1,945. "Improvements in gravity escapements and electric clocks." H. Hardinge, S. Cunynghame and F. Hope-Jones. January 25th.

1,947. "Electrically operated installation for forwarding postal letters and the like through a tube." K. Hansel. January 25th.

1,963. "Improvements in electrical switches." A. Lobel and The British Ever-Ready Electrical Co., Ltd. January 25th.

1,995. "Improvements in electrical plugs, switches and like connections." J. Auld. January 26th.

2,013. "Improvements in electric arc lamps." A. D. Jones. January 26th.

2,014. "Improvements in electric arc lamps." A. D. Jones. January 26th.

2,019. "Electric door-contact with an automatic circuit-breaker." F. Zinth. January 26th. (Complete.)

2,029. "Improvements in electrical devices for exhibiting advertisements." C. C. Hewett and W. F. Foster. January 26th.

2,034. "Improvements in apparatus for producing alternating electric currents." G. Marconi and Marconi's Wireless Telegraph Co., Ltd. January 26th.

2,049. "Improvements in electrical hair-curlers." E. Konig. January 26th. (Complete.)

2,053. "Improvements in electrical apparatus for automatically indicating the positions of trains on railways." B. Trautmann née Sprie. January 26th. Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Dynamo-Electric Machinery. C. A. Parsons and J. H. Armstrong. 26,870. December 23rd.

Sparking Plugs for Use in Internal Combustion Engines. H. G. Longford. 27,046. December 28th.

Dynamo-Electric Machinery. W. L. Hildburgh. 27,140. December 29th.

Instruments for Detecting and for Obviating Leakage from Conductors of Electricity. J. M. Moffat, R. J. Bott, J. W. Manley and Electric Safety Appliances Co. 27,271. December 30th.

Electrical Production of Heat for Cooking and other Purposes. A. F. Berry. 22,314. November 1st.

1906.

Detachable Electric Connections for Electric Lighting and Heating. A. P. Lundberg and G. C. Lundberg. 11,480. May 16th.

Electric Arc Magazine Lamps. J. Brockie. 11,961. May 22nd.

Method of Obtaining Metals from their Ores, or for Heating Substances in Electric Furnaces, and Electric Furnaces for Use Therewith. N. A. Wallin. 12,395. May 28th.

Magnets for Arc Lamps. W. Mathiesen. 15,052. July 2nd.

Process for Obtaining Metals from Ores or Furnace Products in the Electric Furnace. K. Kaiser. 15,818. July 12th. (Date applied for under International Convention, July 19th, 1905.)

Process and Apparatus for Electrolysis of Alloys, Fused Salts, Solutions, Ores or Chemical Compounds. E. A. Ashcroft. 146. January 2nd.

Galvanic Cells. H. A. E. W. L. Fermerling and F. W. Porscke. 234. January 3rd.

Automatic Locking Device for Arc Lamp Couplings and the like. O. Schaefer. 260. January 4th.

High Pressure Electrical Apparatus. A. J. Boult. (F. J. Koch.) 292. January 4th.

Electric Switches. H. E. Edwards. 2,196. January 29th.

Means for Perforating Paper Clips for Telegraphic, Signalling and other Purposes. M. Kolyra. 2,342. January 30th.

Electrical Tumbler Switches. G. Sperryn and W. A. Wood. 5,321. March 3rd.

Electro-Magnetic Motors for Toys and other Purposes. J. L. Potter. 5,325. (Date applied for under International Convention, April 3rd, 1905.) March 5th.

Carriages for Conveying Drums of Electric Cables and such like. W. A. Turner. 6,344. March 16th.

Electric Furnaces. C. Bingham. 7,340. March 26th.

Means for Ascertaining the Predetermined Speed of a Revolving Part, more especially Applicable to Electrical Measuring or Testing Apparatus. Nalder Bros. & Thompson, Ltd., F. H. Nalder and O. Cox. 7,811. March 31st.

Electric Signals for Railways. J. B. Lineback and O. Morris. 10,996. May 10th.

Carbon Electrodes for Primary Batteries. W. Mollenbruck and W. Dielmann. 12,205. May 25th.

Apparatus for Varying Electromotive Force in Finely Divided Steps in Three-Wire Electrical Installations. Siemens Bros.' Dynamo Works. (Siemens Schuckertwerke.) 15,034. July 2nd.

Means for Electrically Lighting and Extinguishing Gas Burners. K. Abel. 16,760. July 25th.

Means for Regulating the Potential Difference at the Terminals of Dynamo-Electric Generators driven at Varying Speeds. E. J. Javaux. 17,785. (Date applied for under International Convention, August 9th, 1905.) August 7th.

Galvanic Batteries. F. Jerabek. 24,194. October 30th.

Electric Meters. C. E. Holmes. 27,623. (Date applied for under International Convention, December 6th, 1905.) December 4th.

Electric Resistances, Contacts and the like. H. S. Hatfield. 18. January 1st.

Electric Furnaces. C. E. Pettitt. 131. January 2nd.

Electrical Signalling Systems. British Thomson-Houston Co. (General Electric Co.) 180. January 2nd.

Electric Measuring Apparatus. British Thomson-Houston Co. and F. Holden. 515. January 8th.